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AUGUST 1981

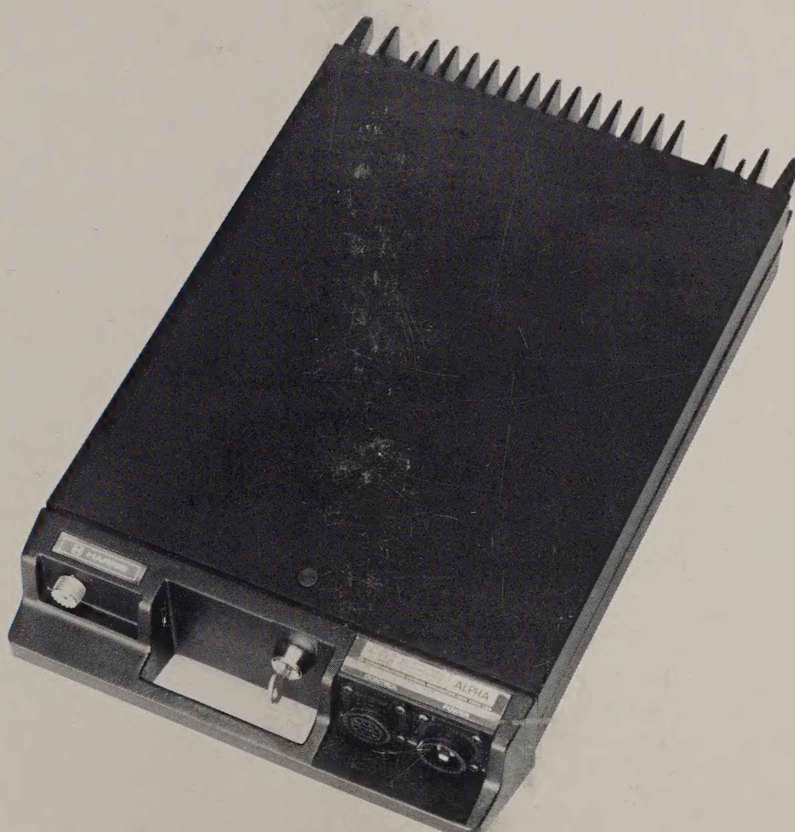
HARRIS

COMMUNICATION AND
INFORMATION PROCESSING

MAINTENANCE MANUAL

ALPHA 2000 SERIES

UHF/VHF MOBILE TELEPHONES



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ADDENDUM

FOR INSTRUCTION MANUAL	ADDENDUM NO.	DATE
10029-0015	L386	March 1983
APPLIES TO: Units Containing Cradle Assembly, Part Number 6624-7220	FOR: ALPHA 2000 Series Maintenance Manual	

This addendum provides the parts list, component location diagram, and schematic diagram for the Cradle Assembly, part number 6624-7220. This information replaces pages 43-47 of the A8 INTFC LGC MOD tab section in the ALPHA 2000 Series UHF/VHF Mobile Telephones Maintenance Manual. Revisions to page 22 of the A8 tab section are also provided.

Make the following changes to A8 INTFC LGC MOD tab section:

- On pages 43-47 write, above the figure title, SEE ADDENDUM L386 for information on Cradle Assembly.
- In paragraph 4.26 (page 22), cross out "fuse F1" on line 7 of that paragraph, and insert "choke L1" in its place.
- In paragraph 4.28 (page 22), cross out "through transistors Q1 and Q2" (last line of that paragraph) and place a period after "Transceiver" (line 7).
- Cross out paragraph 4.30 (page 22) and add: Refer to addendum L386.

Revised paragraph 4.30 of A8 INTFC LGC MOD tab section:

4.30 Normal operation of the Control Unit requires that a signal be provided to indicate to the Interface Logic Module microprocessor whether or not the Handset is on-hook. This is done by means of LED CR3. When the Handset is off-hook, the light from CR3 causes the open-base transistor to conduct producing a high level at J4-6. Conversely, when the Handset is on-hook, a plastic shield blocks light from CR3 and J4-6 goes low. These conditions are noted only when J4-16 has a load of approximately 47K ohm (R76).

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ADDENDUM

FOR INSTRUCTION MANUAL	ADDENDUM NO.	DATE
10029-0015	L386	March 1983

TABLE 1

Cradle Assembly, Parts List

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
	CRADLE ASSY	6624-7220
C1	Capacitor, Electrolytic, 2.2 uF	C18-0050-229
C2	Capacitor, Electrolytic, 2.2 uF	C18-0050-229
C3	Capacitor, Electrolytic, 4.7 uF	C18-0025-479
C4	Capacitor, Electrolytic, 220 uF	C18-0125-221
C5	Capacitor, Electrolytic, 22 uF	C18-0025-220
C6	Capacitor, Electrolytic, 22 uF	C18-0025-220
C7	Capacitor, Ceramic, Axial, 150 pF	C12-0001-039
C8	Capacitor, Ceramic, Axial, 150 pF	C12-0001-039
C9	Capacitor, Ceramic, Axial, 150 pF	C12-0001-039
C10	Capacitor, Ceramic, Axial, 150 pF	C12-0001-039
C11	Capacitor, Electrolytic, 470 uF	C18-0025-471
C12	Capacitor, Ceramic, Axial, 150 pF	C12-0001-039
CR1	Not Used	
CR2	Diode, Signal, 1N4454	CR-0705
CR3	Source/Sensor	CR-0457
CR4	Diode, 1N4004	CR-0725
CR5	Diode, Zener	CR-0267
CR6	Diode, 1N4004	CR-0725
DS1	Light Emitting Diode	6624-2244
U1	Integrated Circuit, LM-380N	IC-0362
U2	Integrated Circuit, 8212	110-0001-003
J1	Not Used	
J2	Not Used	
J3	Not Used	
J4	Header, Rt. Angle	J-0434
J5	Header, Rt. Angle	J-0432
JMP1	Jumper	MP-1142
JMP2	Jumper	MP-1142
JMP3	Wire, Buss, No. 22	W-0928
JMP4	Jumper	MP-1142
JMP5	Wire, Buss, No. 22	W-0928

ADDENDUM

FOR INSTRUCTION MANUAL	ADDENDUM NO.	DATE
10029-0015	L386	March 1983

TABLE 1

Cradle Assembly, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
K1	Relay	K-0122
L1	Choke	6624-2240
Q1	Not Used	
Q2	Transistor, MPS-A13	Q-0076
Q3	Transistor, MPS-U51	Q-0072
R1	Resistor, Composition, 22K ohm ±5%, ¼W	R-1281
R2	Resistor, Composition, 100 ohm ±5%, ¼W	R-1225
R3	Resistor, Composition, 75K ohm ±5%, ¼W	R-1294
R4	Potentiometer, 10K	R-2228
R5	Potentiometer, 5K	R-3441
R6	Resistor, Composition, 120 ohm ±5%, ¼W	R-1227
R7	Resistor, Composition, 560 ohm ±5%, ½W	R-1443
R8	Resistor, Composition, 4.7K ohm ±5%, ¼W	R-1265
R9	Resistor, Composition, 47K ohm ±5%, ¼W	R-1289
R10	Varistor, 33V, 300PF	R-4297
R11	Resistor, Composition, 1.8K ohm ±5%, ¼W	R-1255
R12	Resistor, Composition, 82K ohm ±5%, ¼W	R-1295
R13	Resistor, Composition, 221K ohm ±1%, ⅛W	R-7365
R14	Resistor, Composition, 39K ohm ±5%, ¼W	R-1287
R15	Resistor, Composition, 1.2K ohm ±5%, ¼W	R-1251
R16	Resistor, Composition, 4.7K ohm ±5%, ¼W	R-1265
R17	Varistor, 33V, 300PF	R-4297
R18	Resistor, Composition, 47K ohm ±5%, ¼W	R-1289
S1	Switch, OFF/AUX/ON	S-0213
	Knob, Volume	6624-2202

ADDENDUM

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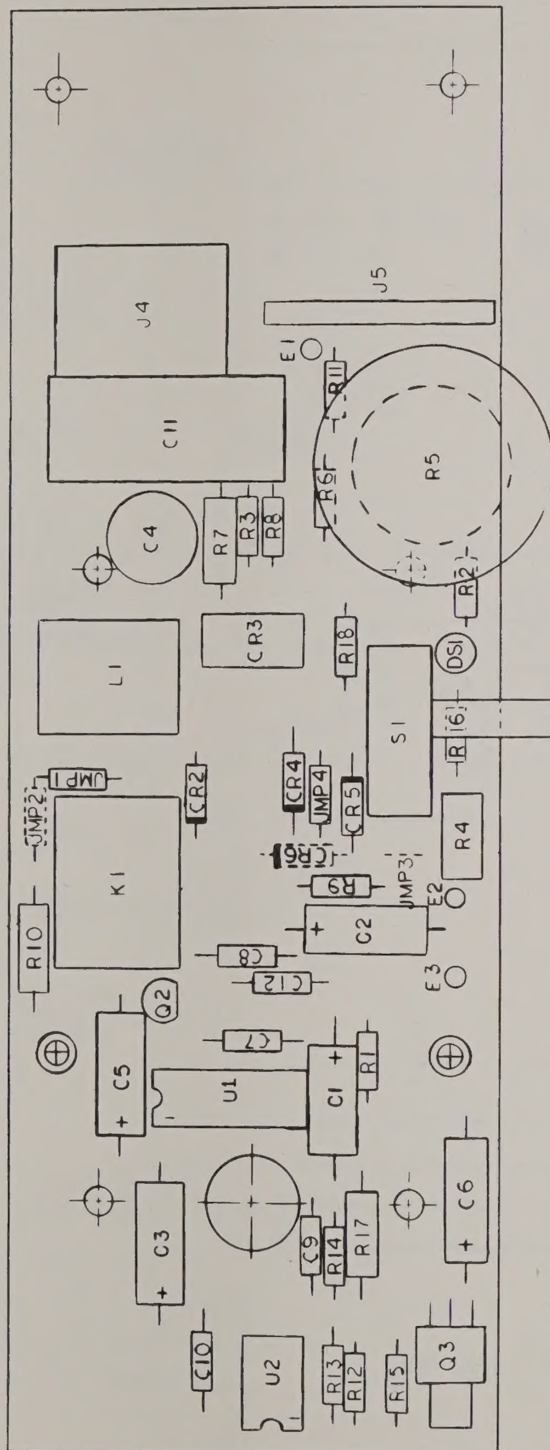

Figure 1. Cradle Assembly, Component Location Diagram (6624-7220)

ADDENDUM NO.	DATE
L386	March 1983

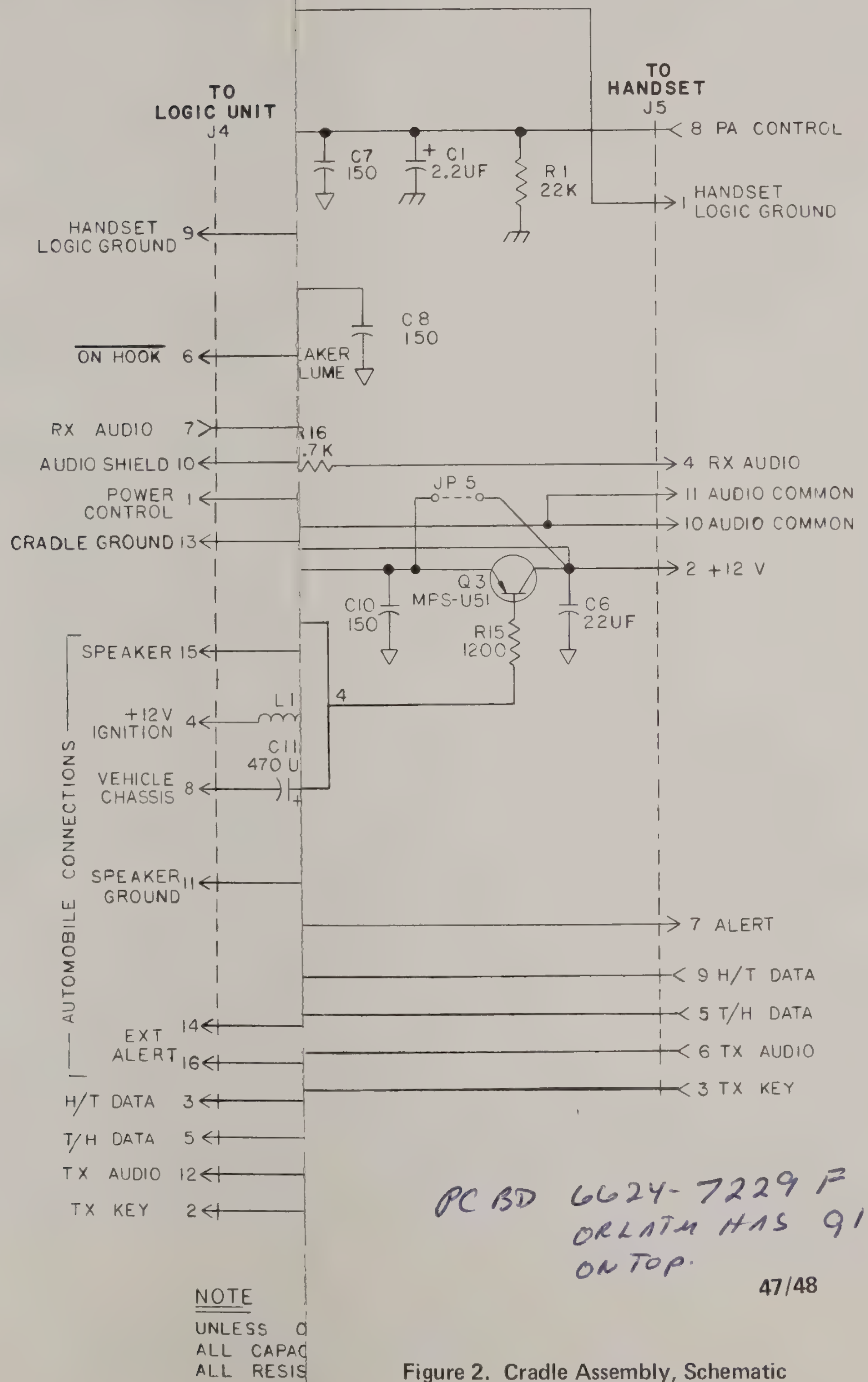

Figure 2. Cradle Assembly, Schematic Diagram (6624-7221)

SHEET 5 OF 5

RF-P-448-C

ADDENDUM

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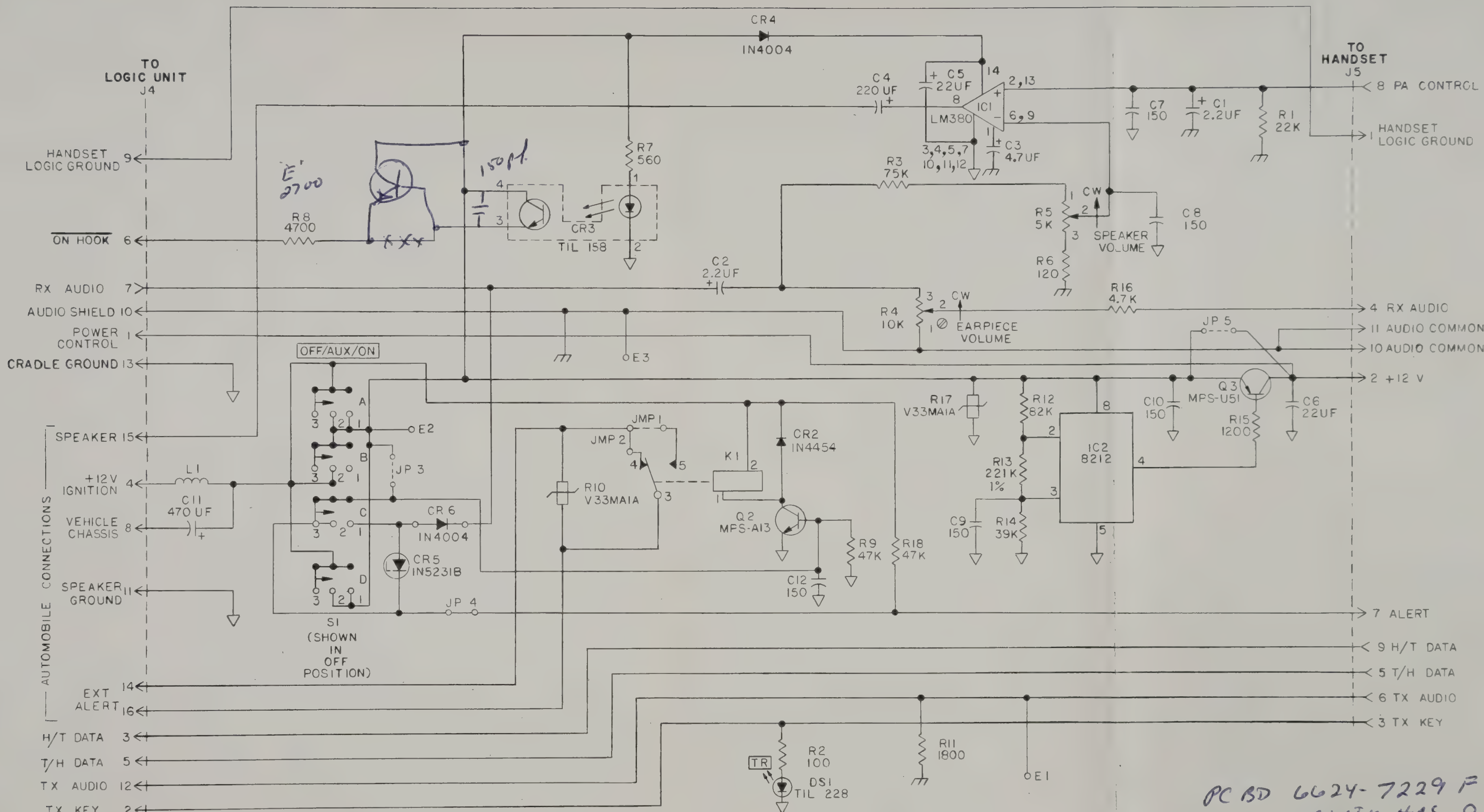

PC BD 6624-7229 F
ORLATM HAS 91
ON TOP.

NOTE

UNLESS OTHERWISE SPECIFIED:
ALL CAPACITORS ARE IN PICOFARADS.
ALL RESISTORS ARE IN OHMS AND 1/4 WATT.

Figure 2. Cradle Assembly, Schematic Diagram (6624-7221)

SHEET 5 OF 5

RF-P-448-C

ADDENDUM

FOR INSTRUCTION MANUAL 10029-0015	
ADDENDUM NO. L257A	DATE 5/22/81

FOR:
Alpha 2000 Maintenance Manual

APPLIES TO:
All Units supplied with 6624-1190 Software

The software supplied on this order will allow an IMTS car telephone to receive calls on 4 of 12 channels and place calls on all 12 channels. Also it only has 1 user channel field (the home field), and only one mode of operation (the auto mode).

To accomplish this the following alterations to the basic software are incorporated.

1) The selection of A1 and PA2 are deleted, this channel field is not available even in the test mode.

2) When the unit powers up and each time an action is completed, eg. user hangs up, the home field is automatically selected.

3) When a call is placed, the control head will have been scanning the home field which will be set in the code plug to the 4 receive channels.

If those 4 channels are busy, the control head will then, at the time a call is initiated, automatically select the A1 channel field. At this time all the A1 channels will be scanned for a free channel. If one is found free the control head will be scanned for a free channel. If one is found free the control head will ANI on that channel. If they are all found to be busy the busy indication "beep" will be given. At this time the user can SEL Q and the control head will scan the A1 channel set for a free channel.

Also the following actions concerning the code plug are to be incorporated to meet the requirements of this special.

1) The manual inhibit bit must be set.

2) The 4 call receive channels are to be programmed into the home field.

3) The 12 call placement channels are to be programmed into the away 1 field.

The test mode is not altered. The A1 channel field can be selected in the test mode along with the manual mode. This allows transmitter testing on any selected channel.

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MAINTENANCE MANUAL

ALPHA 2000 SERIES

UHF/VHF MOBILE TELEPHONES

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WARNING

If your vehicle is equipped with electronic controls (many pre-1980 and most later models are so equipped), use of a transmitter may interfere with electronic controls and cause them to malfunction. Examples of vehicle functions which may involve electronic controls include: fuel delivery systems, engine timing, brakes, emission control, and cruise control. Definite information regarding the type of electronic controls in your vehicle can only be obtained from the manufacturer. Consult your vehicle dealer regarding the need for modifications to your vehicle's electronic controls before installation or use of a transmitter.

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ABOUT THIS MANUAL

This is a tabulated manual. General Information is contained in the front of this manual. Detailed information on subassemblies is contained in individual tab sections.

SUPPLEMENTARY INFORMATION

Information relating to the IMTS Signaling System, and the Alpha 40 Control Unit are included in the A8 Tab Section.

Chapter 1

GENERAL INFORMATION

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SPECIFICATIONS

General

Frequency Range	VHF: 132 to 150.8 MHz and 150.8 to 174 MHz UHF: 406 to 470 MHz and 450 to 512 MHz
Emission	16F3, 15F2
Frequency Stability	±0.0005% standard (−30° to +60° C), ±0.0002% optional
Frequency Control	Synthesized, 128 duplex channels (All Radio Common Carrier and Mobile Telephone Service channels for UHF or VHF operations are included in one standard frequency PROM. Other frequencies can also be programmed.)
Primary Voltage Source	13.6 Vdc, ±20% negative ground
Current Drain	Off: 10MA maximum; 5 MA typical (memory supply) Receive-standby: 0.6 Amp. radio only, 0.8 Amp. with Control Unit Transmit (max.): 12 Amp. UHF, 13 Amp. VHF (at full RF output)
Duty Cycle	Continuous
Operating Temperature Range	−30° to +60°C
Overall Size	3.4H × 11W × 17D in. (8.7H × 27.9W × 43.2D cm)
Weight	24 lbs. (10.9 kg)

Duplex Operation

Duplexer	Internal to Transceiver
Duplex Frequency Separation	5 MHz or greater standard, less than 5 MHz special order (consult factory)
Duplex Channel Spread	300 kHz standard (consult factory for greater spread)

Transmitter

RF Output	VHF: 50 watts adjustable to 25 watts or fixed at 30 watts UHF: 30 watts adjustable to 15 watts or fixed at 25 watts	
Frequency Deviation	±5 kHz	
Spurious and Harmonic Attenuation	80 dB	
Hum and FM Noise	−60 dB (C message weighting)	
Audio Response	Within +1 and −3 dB of true 6 dB per octave pre-emphasis characteristic from 300 to 3000 Hz	
Audio Distortion	3% maximum	
Antenna Impedance	50 ohm nominal. Operable into 3:1 VSWR (Infinite VSWR without damage)	
Tx FCC ID	UHF: AQZ9PTTX2U0A2 (15–30W, .0002%) AQZ9PTTX2U0A5 (15–30W, .0005%) AQZ9PTTX2U0B2 (25W, .0002%) AQZ9PTTX2UOB5 (25W, .0005%)	VHF: AQZ9PTTX2VOA2 (25–50W, .0002%) AQZ9PTTX2VOA5 (25–50W, .0005%) AQZ9PTTX2VOB2 (30W, .0002%) AQZ9PTTX2VOB5 (30W, .0005%)

Receiver

Sensitivity	Usable: 0.35 μV for 12 dB Sinad Quieting: 0.50 μV for 20 dB Quieting	
Adjacent Channel Selectivity	VHF: −90 dB at ±30 kHz UHF: −85 dB at ±25 kHz	
Intermodulation Rejection	−80 dB	
Audio Power Output	100 MW at 3% distortion	
Modulation Acceptance	±7 kHz	
Hum and Noise	−60 dB (C message weighting)	
Spurious and Image Rejection	90 dB	
Rx FCC ID	UHF: AQZ9PTRX2U002 (.0002%) AQZ9PTRX2U005 (.0005%)	VHF: AQZ9PTRX2V002 (.0002%) AQZ9PTRX2V005 (.0005%)

Alpha 40 Control Unit

Mechanical

Size: Handset and Cradle	9.25H × 2.88W × 3.55D in. (23.5H × 7.3W × 9.0D cm)
Weight:	3 lbs. (1.35 kg)
Case: Texture	Smooth
Color	High-gloss black or Harris white
Material	High-impact, heat resistant ABS resin, automotive type
Key Pad: Size	Configuration: 3 × 5 keys
Number of Keys	15 with tactile feedback
Key Spacing	.56 in. (1.43 cm)
Display: Size	.102 × .062 in. (.259 × .157 cm)
Configuration	Single row, 7 digit, 7 segment with decimal point
Spacing	.2 in. (.51 cm)
Mounting System	Pedestal type, universal mount ball and socket adjustable (optional flat-surface mount)

Electrical

Supply	13.6 Vdc ±20%
Temperature Range	−30° to +60°C
Operating Channels	32 maximum stored in program plug (PROM)
Programmable Channels	32 maximum stored in user memory
Home Channels	32 maximum stored in program plug (PROM)
Audio Output Speaker	Nominal 82 dB SPL @ 30 in. (76 cm) adjustable 5% T.H.D. at 1 kHz with 3 kHz deviation
Audio Output Earpiece	Nominal 82 dB SPL @ 1 in. (2.5 cm) adjustable 2% T.H.D. at 1 kHz with 3 kHz deviation
Audio Output Microphone	−3 dBm (600 ohm unbalanced) ±3 dB with 1% T.H.D.
Speed Dialing Storage	10 numbers, 14 digits each
Auxiliary Control	Relay contacts rated at 2 A, 28 Vdc resistive w/transient suppression.

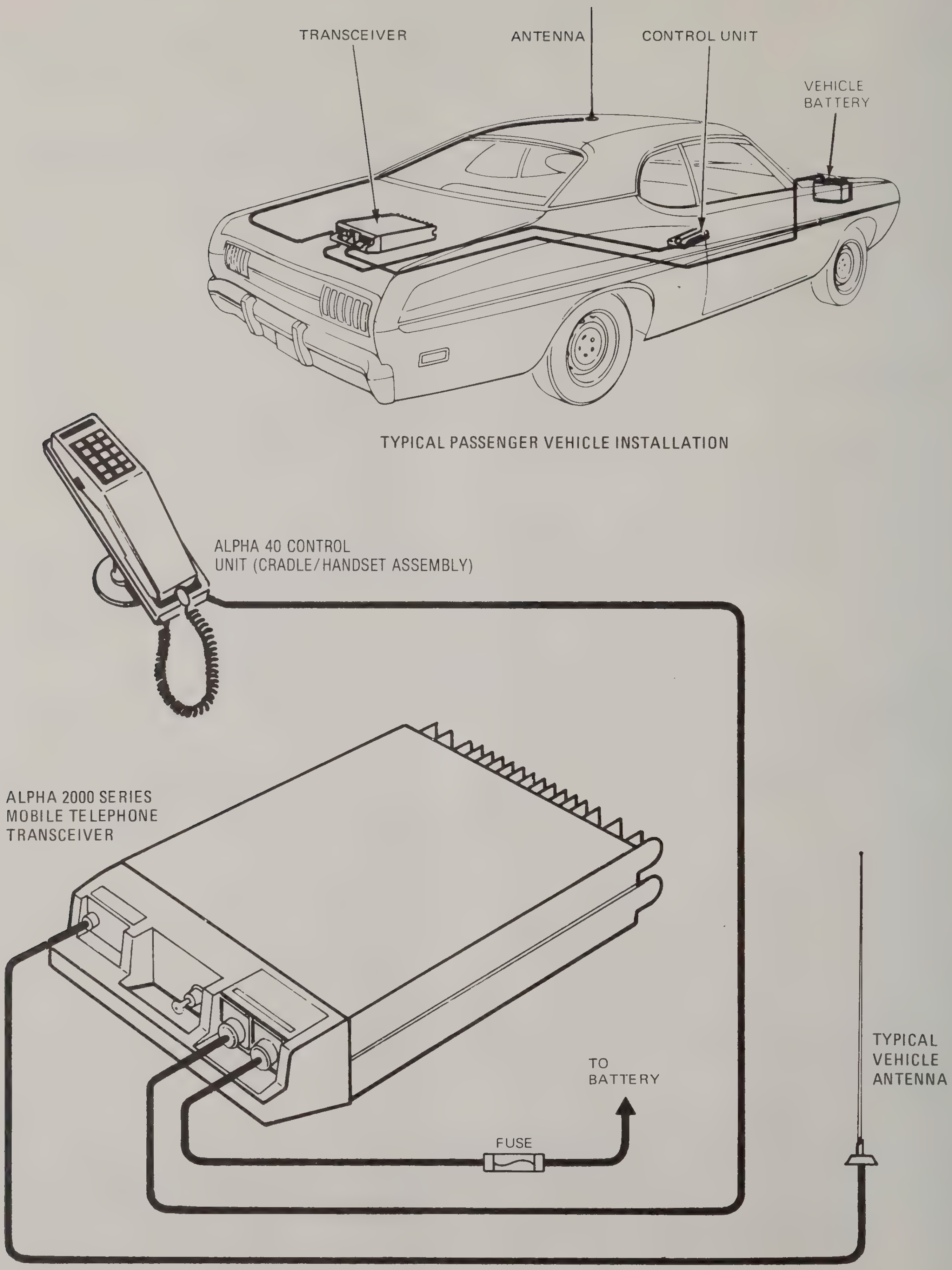


Figure 1-1. Typical Alpha 2000 Series UHF/VHF Mobile Telephone System Setup

ALPHA 2000 SERIES UHF/VHF MOBILE TELEPHONES
CHAPTER 1
GENERAL INFORMATION

1. INTRODUCTION

1.01 The Alpha 2000 Series UHF/VHF Mobile Telephone is an all solid-state trunk-mounted Transmitter and Receiver on a common chassis (Transceiver). Operating in the full-duplex mode, this Transceiver provides highly reliable operation for TELCO and RCC users. The Transceiver may operate with up to 32 of the 128 programmed channels in the 406 to 512 MHz band or in the 132 to 174 MHz band.

1.02 The Transceiver is readily installed in virtually any vehicle due to its compact size, configuration and light weight (refer to figure 1-1). Figure 1-2 illustrates operation in a typical IMTS system. Electrical connections to the Transceiver are made through three front-panel mounted connectors (power cable, control cable, and antenna).

1.03 The die-cast chassis is secured to the bottom cover/mounting tray by a key-operated lock. The top cover is secured by a push-button catch which is also controlled by the key-lock. To open Transceiver, the key must first be inserted and turned horizontally. To remove top cover, push button on front center of cover, slide back and remove. To remove Transceiver from mounting tray, turn key horizontally, grab handle and pull forward. It is not necessary to remove top cover when removing Transceiver from mounting tray. (If Transceiver is not mounted in vehicle, it will be easier to remove bottom cover as follows: stand unit on heat sink fins, grab both sides of bottom cover and pull down firmly.) Chassis covers are designed to fit tightly to minimize vibration, provide for good shielding and keep dust out.

1.04 Operating control functions are derived from the Alpha 40 Control Unit and the Interface Logic Module for IMTS/MTS and IMTS/2805 Systems. Interfacing is available for almost all other types of Control Units and operating systems.

1.05 The use of silicon transistors and integrated circuits ensures reliable operation over the wide ambient temperature range encountered in vehicular applications. Electronic voltage regulation eliminates voltage fluctuations in the Transceiver caused by varying voltage levels in the vehicle's electrical system. The Transceiver is also protected against reverse polarity power input damage.

2. DESCRIPTION

2.01 The following description is based upon figure 1-3, the Simplified Transceiver Signal Flow Diagram. This diagram covers both UHF and VHF Transceivers.

A. Receiver

2.02 Incoming signals pass through the Duplexer to the Receiver Front End Module. The Duplexer is a passive device that allows simultaneous reception and transmission at different frequencies with a common antenna.

2.03 UHF Receiver: Input signals to the UHF Receiver Front End Module pass through a three-pole filter before amplification by a single rf stage. The amplifier output is coupled to the mixer by a two-pole filter where the signal is combined with the local oscillator (LO) signal. The LO signal is produced by tripling the Rx VCO Module output and filtering it with a two-pole filter. The resulting 21.4 MHz output signal is connected via a coaxial cable to the IF/Audio Module. The front end rf amplifier, mixer and tripler board assemblies are contained in a completely enclosed die-cast housing. All rf connections to the module are made with coaxial cables. All dc connections are made through these same coaxial cables or via a feed-through capacitor. The housing also contains cavities for the front end and tripler filters. The module can be tuned over the 406 to 512 MHz range without component changes.

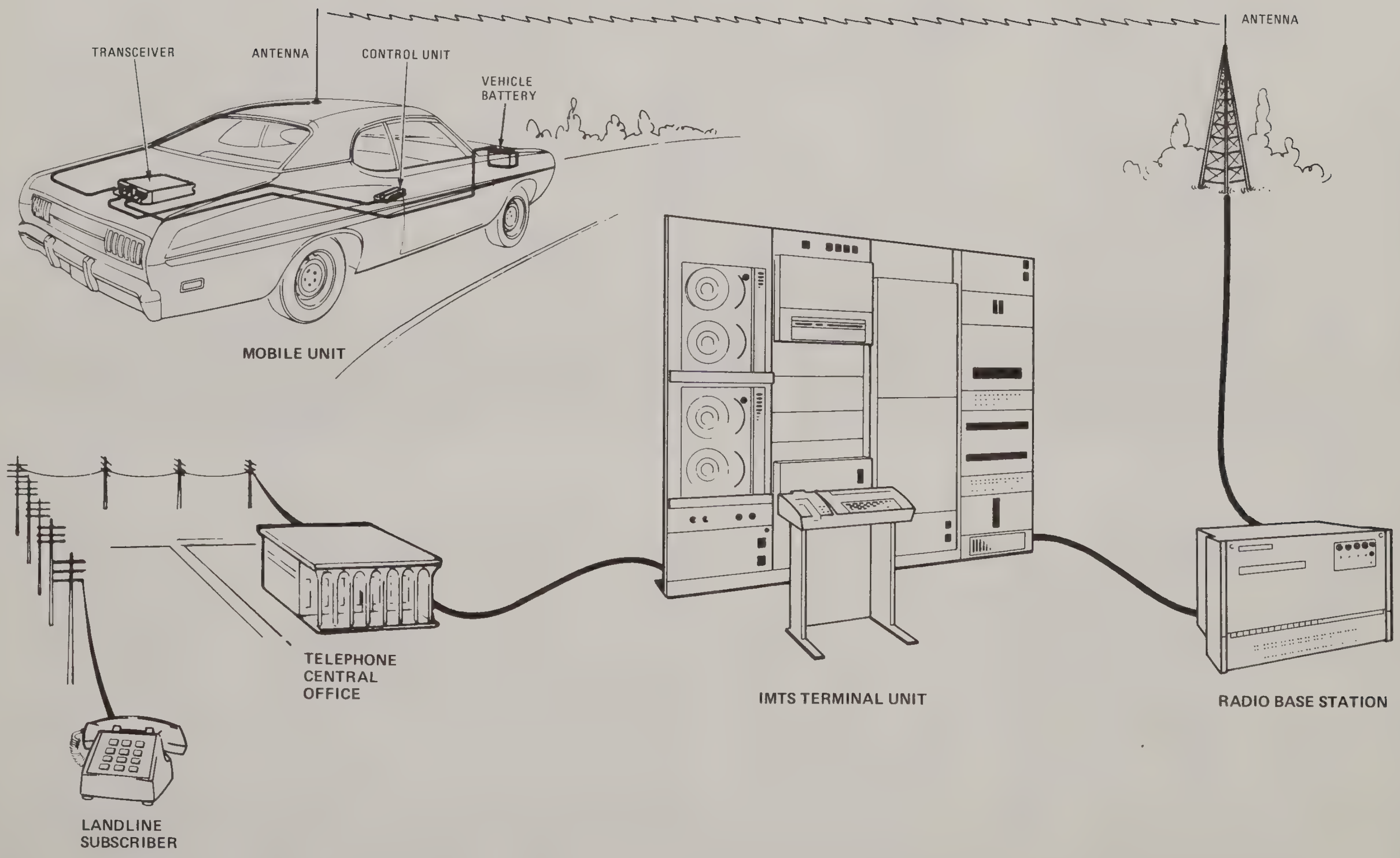


Figure 1-2. IMTS System

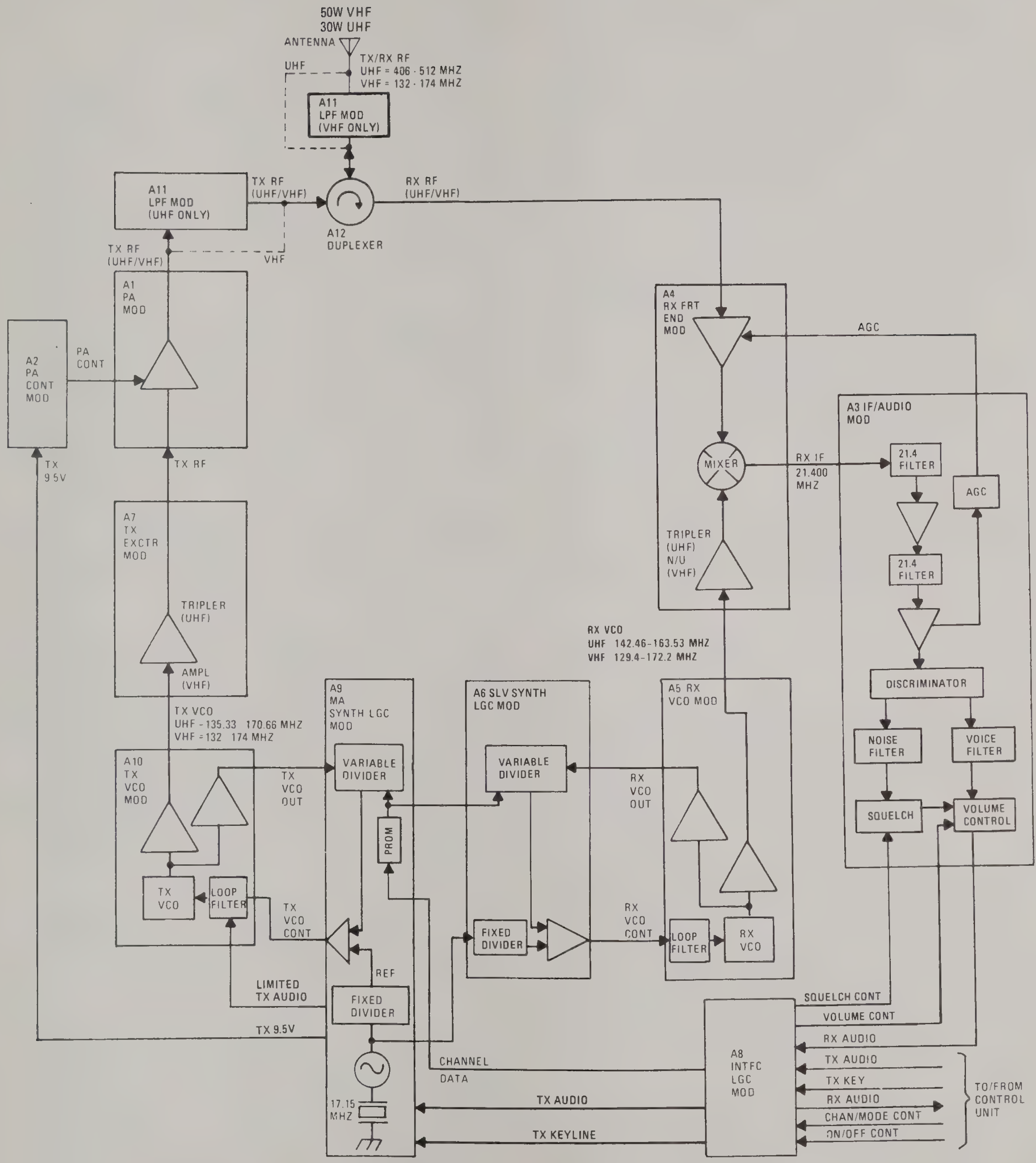


Figure 1-3. Overall Simplified Signal Flow Diagram

where it is combined with the filtered (two-pole) Rx VCO Module output. The resulting 21.4 MHz output signal is connected via a coaxial cable to the IF/Audio Module. The front end rf amplifier and mixer circuit are mounted on a common board assembly. All rf connections to the board assembly are made by coaxial cables. Dc connections are made by the IF coaxes or filtered wires. The module covers the 132 to 174 MHz band in two ranges: 132 to 150.8 MHz and 150.8 to 174 MHz.

2.05 IF and audio circuits are mounted on a common board assembly which is used for both UHF and VHF. The 21.4 MHz IF signal from the Front End Module is amplified by a two-stage circuit with a six-pole crystal input filter and a four-pole crystal output filter. An integrated circuit driven by the IF output signal functions as a limiter and discriminator, and also provides an AGC voltage for the front end rf amplifier. This reduces its gain under strong signal conditions and improves IM characteristics. The recovered audio is processed by six stages of audio shaping and buffering. The audio output from this module, drives the tone filter circuits in the Interface Logic Module and is then routed to the Control Unit.

B. Transmitter

2.06 The Transmitter contains a power amplifier, an exciter, and a power amplifier control circuit. Transmit audio from the Interface Logic Module is limited and filtered on the Master Synthesizer Logic Module and is then applied to the Tx VCO Module. The UHF and VHF power amplifier circuits are mounted on similar die-cast rear panel heat sinks. This casting is mounted at the rear of the die-cast chassis which provides an rf tight shielded enclosure. Input and output signals are carried by coaxial cables and dc connections are made via feed-through capacitors. The power control circuit regulates dc voltages for the power amplifier. It also controls the output power level, monitors the power amplifier circuit, and heat sink temperature.

2.07 UHF Transmitter: In the UHF Transmitter, the Tx VCO Module output is tripled to obtain the final operating frequency. The active tripler board assembly is contained in a die-cast housing mounted to the chassis. The tripler receives its rf drive and dc supply from the Tx VCO Module via a coaxial cable. A three-pole cavity filter (part of the die-cast housing) filters the tripled output. The tripler can be tuned over the 406 to 512 MHz range without component changes.

2.08 The UHF Power Amplifier (PA) is a five-stage broad-band microstrip circuit that covers the 406 to 512 MHz band in two ranges: 406 to 470 MHz and 450 to 512 MHz. The output of the PA connects to the Low-Pass Filter Module, mounted in a cast-in compartment on the chassis. Two filters are available for use in the 406 to 512 MHz band: 406 to 470 MHz and 470 to 512 MHz.

2.09 The UHF PA Signal is then sent to the duplexer which filters out energy at the receive frequency and allows the Transmitter and Receiver to operate simultaneously with the same antenna. Five duplexers are available for use in the 406 to 512 MHz band: 406 to 430 MHz, 430 to 450 MHz, 450 to 470 MHz, 470 to 490 MHz, and 490 to 512 MHz. Duplexers are designed for a transmit/receive frequency spacing of 5 MHz. (For information on other spacings, contact the Field Service Department of the RF Communications Division.)

2.10 VHF Transmitter: In the VHF Transmitter the Tx VCO Module output is amplified and filtered by the Transmit Exciter Module. This module's two-stage amplifier and a band-pass filter provide a clean drive signal for the power amplifier circuit. All circuitry is mounted on one board assembly with rf input and output connections being made by coaxial cables. The Transmit Exciter Module covers the 132 to 174 MHz band in two ranges: 132 to 150.8 MHz and 150.8 to 174 MHz.

2.11 The VHF PA Module is a three-stage broad-band microstrip circuit that covers the 132 to 174 MHz band in two ranges: 132 to 150.8 MHz and 150.8 to 174 MHz.

2.12 The VHF PA Module output passes through the Duplexer and Low Pass Filter Module to the front panel antenna connector. The Low-Pass Filter Module is mounted in a cast-in compartment on the chassis. Two filters and two duplexers are available for use in the 132 to 174 MHz band: 132 to 150.8 MHz, and 150.8 to 174 MHz. Duplexers are designed for a minimum transmit/receive frequency spacing of 5 MHz. (For information on other spacings, contact the Field Service Department of the RF Communications Division.)

C. Frequency Generation

2.13 The Transceiver uses frequency synthesis techniques which include independent receive and transmit voltage controlled oscillators (VCO) to generate the Receiver local oscillator frequency and the Transmitter output frequency. Each VCO Module contains a VCO board assembly and a Loop Filter board assembly. The Transmit VCO Module in conjunction with the Master Synthesizer Logic Module forms the transmit synthesizer loop circuit. The Receive VCO Module in conjunction with the Master and Slave Synthesizer Logic Modules forms the receive synthesizer loop circuit. The transmit and receive VCOs generate ⅓ the desired frequency in the UHF Transceiver, and the desired frequency in the VHF Transceiver. A portion of each VCO Module output is divided to a lower frequency by a prescaler. The prescaler output drives a variable ratio divider located in a large scale integrated circuit (LSI).

2.14 The transmit prescaler and LSI are located on the Master Synthesizer Logic Module. A fixed-ratio divider in the LSI, divides the output of a temperature compensated frequency standard down to a frequency of $4.16\overline{6}$ KHz (Jmp 2 out) or 5.000 KHz (Jmp 2 in) in the VHF Transceiver. Circuitry in the LSI compares the divided VCO and standard signals, and generates a control voltage proportional to the difference between them. This control voltage is filtered and combined with the modulation signal on the Loop Filter board assembly. The processed error signal is fed to the VCO board assembly where it acts to keep the VCO and frequency standard locked together. The frequency that the VCO Module generates is determined by the value of the division ratio set for the LSI. A programmable read-only memory (PROM), on the Master Synthesizer Logic Module contains division ratio information for up to 128 receive and 128 transmit frequencies.

2.15 In the receive loop, the Slave Synthesizer Logic Module uses the reference signal and division ratio information from the Master Synthesizer Logic Module to drive the receive prescaler and LSI. It operates similarly to the Tx loop and keeps the receive VCO locked to the frequency standard. Although both synthesizer loops share a common reference, separate receive and transmit division ratio memory locations in the PROM allow independent control of each loop.

D. Transceiver Control

2.16 The Interface Logic Module in conjunction with the Control Unit, directs operation of the Transceiver. This allows the Transceiver to operate in a variety of mobile telephone systems. Each system has its own tones, timing sequences, and method of signalling. Operation in different systems is normally controlled by different Interface Logic Modules. The two standard control options use the Harris Alpha 40 Control Unit. The Interface Logic Module interconnects the Control Unit with the IF/Audio Module (for Receive audio and tone signals) and the Master Synthesizer Logic Module (for transmit audio, tone signals, and channel control signals).

2.17 The Alpha 2244 series is designed for TELCO use, with Mobile Telephone System (MTS) in its manual mode, and Improved Mobile Telephone System (IMTS) in its automatic mode.

2.18 The Alpha 2247 series is designed for RCC use, with IMTS in its automatic mode, and 2805 in its manual mode.

2.19 In each system, independent microprocessors in the Control Unit and on the Interface Logic Module communicate via the control cable, to direct operation of the Transceiver. Some of the operations performed include: tone generation, tone detection, control of the receive and transmit audio paths, selection of an operating channel, display control, electronic lock, and telephone number storage.

2.20 Additional information regarding the operation of the Alpha 40 Control Unit features may be found in the Operators Manual. (PM-1569).

2.21 The Transceiver is designed for universal applications with a wide variety of control units having their own tone encoding and decoding circuitry. This series will accept either binary or line per channel frequency control.

2.22 The Transceiver does not have any external controls or indicators. The Transceiver is normally controlled by a separate Control Unit.

2.23 Refer to the latest RF Communications catalog for details of Alpha 2000 series configurations and options available.

3. CHANNEL/FREQUENCY INFORMATION

3.01 As many as 128 transmit channels and 128 independent receive channels, may be programmed into the synthesizer PROM. Normally however, only 32 channels can be addressed by the Alpha 40 Control Unit. In standard Alpha 2200 mobile telephones, channel information is divided into four 32-channel groups: VHF TELCO, UHF TELCO, VHF RCC, and UHF RCC. Table 1-2 provides a listing of these channel groups as normally provided in the synthesizer PROM. Selection of the desired channel group is made by jumpers on the Interface Logic Module and Master Synthesizer Logic Module.

	Master Synth. Logic Module JMP3	Interface Logic Module JMP2
IN	UHF	RCC
OUT	VHF	TELCO

3.02 Data in "PROM Channel" column of table 1-2, contains the binary address presented to PROM on the Master Synthesizer Logic Module.

3.03 Programmed into the code plug (PROM) in the Interface Logic Module are the actual channels available to the operator at the Handset and how they are displayed in the Handset. Details on programming the code plug are covered in the maintenance manual.

3.04 Table 1-3 shows Alpha 40 channel displays for different systems. The "odd bit" and "offset units" are not typically used, since all channels (not just odd-numbered VHF channels) are normally available in the Alpha 2200 Transceiver. If all channels of a particular system are not desired or available, only the desired channels are programmed into the A1 field of the code plug. The 'Transceiver channel' numbers in Table 1-2 correspond to the 32 channels available in any one field of the code plug.

4. ACCESSORIES

4.01 Accessories are listed in table 1-1.

TABLE 1-1. Accessories

Item	RF Part Number	VHF	UHF
* Ancillary Kit	10029-0020	x	x
* Cover Kit	10029-0080	x	x
* Battery Cable	10029-0099	x	x
* Control Cable	10029-0098	x	x
Maintenance Kit	10029-0178	x	x
Antenna (¼); RF-460H	E75-0001-000	x	x
Antenna, VHF, Gain; RF-1582H	E75-0002-000	x	
Antenna, UHF, Gain; RF-4641H	E75-0003-000		x
* Alpha 40 Control Unit			
Black	10029-0700	x	x
White	10029-0701	x	x
Maintenance Manual	10029-0015	x	x
* Alpha 40 Control Unit Operators Manual	PM-1569	x	x

* are supplied

TABLE 1-2

Standard UHF/VHF Mobile Telephone Transceiver Operating Frequencies

PROM Channel	Transceiver Channel	FTx (MHz)	FRx (MHz)	Designator	Display
PROM PAGE 1 — UHF (RCC)					
000	1	459.025	454.025	21	21
001	2	459.050	454.050	22	22
002	3	459.075	454.075	23	23
003	4	459.100	454.100	24	24
004	5	459.125	454.125	25	25
005	6	459.150	454.150	26	26
006	7	459.175	454.175	27	27
007	8	459.200	454.200	28	28
008	9	459.225	454.225	29	29
009	10	459.250	454.250	30	30
010	11	459.275	454.275	31	31
011	12	459.300	454.300	32	32
012	13	459.325	454.325	33	33
013	14	459.350	454.350	34	34
014	15				
015	16				
016	17				
017	18				
018	19				
019	20				
020	21				
021	22				
022	23				
023	24				
024	25				
025	26				
026	27				
027	28				
028	29				
029	30				
030	31				
031	32				
PROM PAGE 2 — VHF (RCC)					
032	1	158.490	152.030	1	1
033	2	158.505	152.045	2	2
034	3	158.520	152.060	3	3
035	4	158.535	152.075	4	4
036	5	158.550	152.090	5	5
037	6	158.565	152.105	6	6
038	7	158.580	152.120	7	7
039	8	158.595	152.135	8	8
040	9	158.610	152.150	9	9
041	10	158.625	152.165	10	10
042	11	158.640	152.180	11	11

TABLE 1-2

Standard UHF/VHF Mobile Telephone Transceiver Operating Frequencies (Cont.)

PROM Channel	Transceiver Channel	FTx (MHz)	FRx (MHz)	Designator	Display
PROM PAGE 2, CONT					
043	12	158.655	152.195	12	12
044	13	158.670	152.210	13	13
045	14				
046	15				
047	16				
048	17				
049	18				
050	19				
051	20				
052	21				
053	22				
054	23				
055	24				
056	25				
057	26				
058	27				
059	28				
060	29				
061	30				
062	31				
063	32				
PROM PAGE 3 — UHF (TELCO)					
064	1	459.375	454.375	QC	31
065	2	459.400	454.400	QJ	32
066	3	459.425	454.425	QD	33
067	4	459.450	454.450	QA	34
068	5	459.475	454.475	QE	35
069	6	459.500	454.500	QP	36
070	7	459.525	454.525	QK	37
071	8	459.550	454.550	QB	38
072	9	459.575	454.575	QO	39
073	10	459.600	454.600	QR	40
074	11	459.625	454.625	QY	41
075	12	459.650	454.650	QF	42
076	13				
077	14				
078	15				
079	16				
080	17				
081	18				
082	19				
083	20				
084	21				
085	22				
086	23				
087	24				

TABLE 1-2

Standard UHF/VHF Mobile Telephone Transceiver Operating Frequencies (Cont.)

PROM Channel	Transceiver Channel	FTx (MHz)	FRx (MHz)	Designator	Display
PROM PAGE 3, CONT					
088	25				
089	26				
090	27				
091	28				
092	29				
093	30				
094	31				
095	32				
PROM PAGE 4 — VHF (TELCO)					
096	1	157.740	152.480	JJ	1
097	2	157.755	152.495		2
098	3	157.770	152.510	JL	3
099	4	157.785	152.525		4
100	5	157.800	152.540	YL	5
101	6	157.815	152.555		6
102	7	157.830	152.570	JP	7
103	8	157.845	152.585		8
104	9	157.860	152.600	YP	9
105	10	157.875	152.615		10
106	11	157.890	152.630	YJ	11
107	12	157.905	152.645		12
108	13	157.920	152.660	YK	13
109	14	157.935	152.675		14
110	15	157.950	152.690	JS	15
111	16	157.965	152.705		16
112	17	157.980	152.720	YS	17
113	18	157.995	152.735		18
114	19	158.010	152.750	YR	19
115	20	158.025	152.765		20
116	21	158.040	152.780	JK	21
117	22	158.055	152.795		22
118	23	158.070	152.810	JR	23
119	24	158.085	152.825		24
120	25	158.100	152.840	JW	25
121	26				
122	27				
123	28				
124	29				
125	30				
126	31				
127	32				

TABLE 1-3

Alpha 40 Handset Display Programming

		TELCO SYSTEMS		RCC SYSTEMS	
	BASIC	VHF	UHF	VHF	UHF
	1	JJ 1	QC 31	1	21
	2	2	QJ 32	2	22
	3	JL 3	QD 33	3	23
	4	4	QA 34	4	24
	5	YL 5	QE 35	5	25
	6	6	QP 36	6	26
	7	JP 7	QK 37	7	27
	8	8	QB 38	8	28
	9	YP 9	QO 39	9	29
	10	10	QR 40	10	30
	11	YJ 11	QY 41	11	31
	12	12	QF 42	12	32
	13	YK 13		13	33
	14	14			34
	15	JS 15			
	16	16			
	17	YS 17			
	18	18			
	19	YR 19			
	20	20			
	21	JK 21			
	22	22			
	23	JR 23			
	24	24			
	25	JW 25			
	26				
	27				
	28				
	29				
	30				
	31				
	32				
ODD BIT	NO	NO	NO	NO	NO
OFFSET UNITS	0	0	0	0	0
OFFSET TENS	0	0	3	0	2

Chapter 2

INSTALLATION

TABLE OF CONTENTS

LIST OF FIGURES

ALPHA 2000 SERIES UHF/VHF MOBILE TELEPHONES
CHAPTER 2
INSTALLATION

1. GENERAL

1.01 The procedure for installing the Transceiver in a vehicle follows accepted standard installation practices. The installation requirements are less critical than usual due to the compact size and light weight of the Transceiver. A two conductor power cable provides an electrical interconnection between the Transceiver and vehicle battery. A small multiconductor cable provides an electrical interconnection between the Transceiver and Control Unit. A coax cable connects the Transceiver to the antenna. The Control Unit consists of the Cradle/Handset Assemblies. A retractable coil cord connects the Handset to the Cradle.

1.02 Prior to physically installing the Transceiver in a vehicle, attention should be given to the user's requirements and interaction with controls used during the normal operation of a vehicle. The Control Unit (and associated speaker, if used) should in no way interfere with controls used during normal operation of a vehicle. Also, the Control Unit should not be installed in front of either a heater or air-conditioner air outlet.

1.03 The installation of the Transceiver in automobiles having electronic antiskid braking or fuel injection systems, requires special attention. Radio interference while transmitting can result in erratic performance of the antiskid and fuel injection systems. This can be noticed by improper or erratic operation of the engine or braking system, vehicle stop lights, or the presence of unusual noises in the received signal.

1.04 The Transceiver and antenna should be located as far as possible from the brake system or fuel injection modulator box. Since the locations of the modulator varies with the manufacturer and model, refer to the vehicle service manual to determine exactly where the modulator box is installed. The interconnecting cable between the Transceiver and Control Unit should be routed along the opposite side of the vehicle from the brake modulator box. If at all possible, this cable should be routed inside the lower body channel of the vehicle to further reduce the possibility of any interference. The antenna cable should also be located on the opposite side of the vehicle from the modulator box and should be as short as possible. The Transmitter should not be operated while the vehicle is in motion with the trunk lid open, especially if the modulator box is installed in the vehicle trunk.

2. MECHANICAL INSTALLATION

2.01 The installation requires the following:

- Mounting the Control Unit in the passenger compartment.
- Mounting the Transceiver in the trunk.
- Routing the control cable from the Cradle to the Transceiver.
- Routing the power cable from the Transceiver to the vehicle battery.
- Mounting the external speaker and/or horn relay accessories.
- Mount antenna and route cable.

CAUTION

Before making any mounting holes in the vehicle, check that no damage will result to the fuel tank, fuel or brake lines, vehicle wiring, transmission, air conditioning, or heater components. When drilling through carpet, precut the carpet backing to prevent unraveling.

A. Transceiver

(a) Referring to figure 2-1, place Transceiver mounting tray in desired location. Allow at least seven inches in front and two inches in back to the nearest obstruction. The location should allow the tray to be mounted without twisting. (Shims may be used.)

(b) Mark and drill (use a No. 6 bit) three mounting holes. (0.204-inch or 3/16-inch)

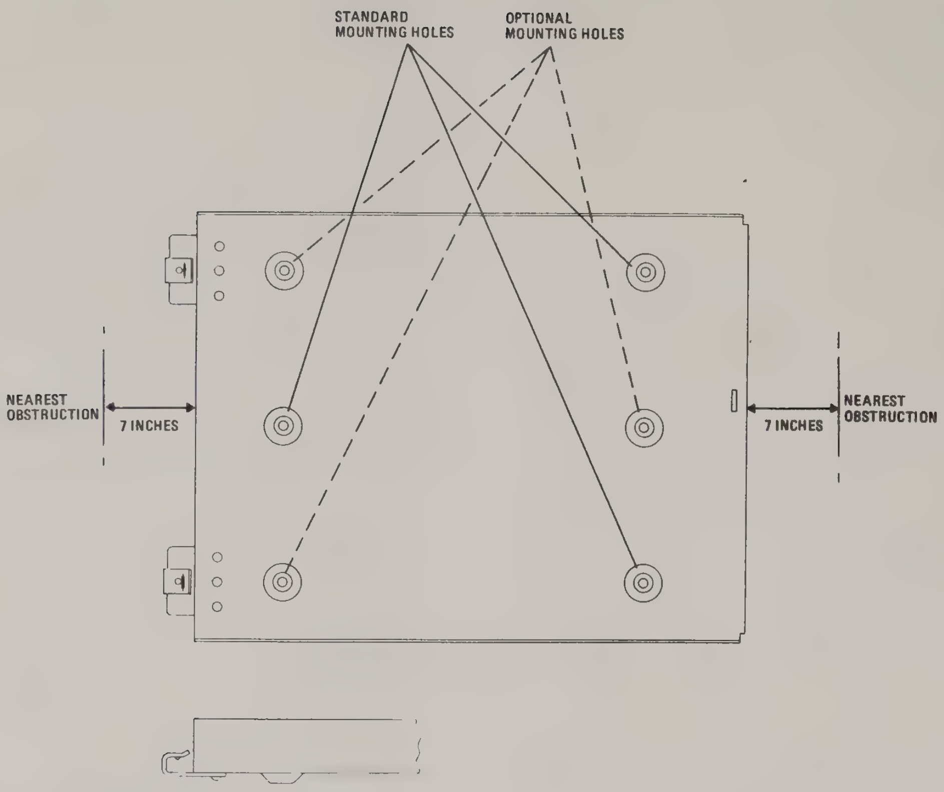


Figure 2-1. Transceiver Mounting Details

(c) Secure mounting tray using three ¼-inch × 1-inch long self-tapping screws and ¼-inch split lockwashers.

(d) Rotate key lock 90° counterclockwise and slide Transceiver into mounting tray so that fingers on mounting tray slide over lips on bottom of Transceiver heat sink.

(e) Rotate key lock 90° clockwise to lock Transceiver into mounting tray.

B. Alpha 40 Control Unit

2.02 Select a suitable location for the Control Unit. Position it so that the Handset is within easy reach of the vehicle operator. Do not install the Cradle in front of heater outlet, or where vehicle operation might be impaired. Starting from the intended location of the Cradle, route the end of the control cable with the 14-pin round connector through the vehicle to the Transceiver location. Allow a minimum of 12-inch service loop at each end of the cable. Where cables are routed through the fire wall or other partitions, use grommets to prevent cutting or chafing of the insulation. Cradle may be mounted with or without pedestal.

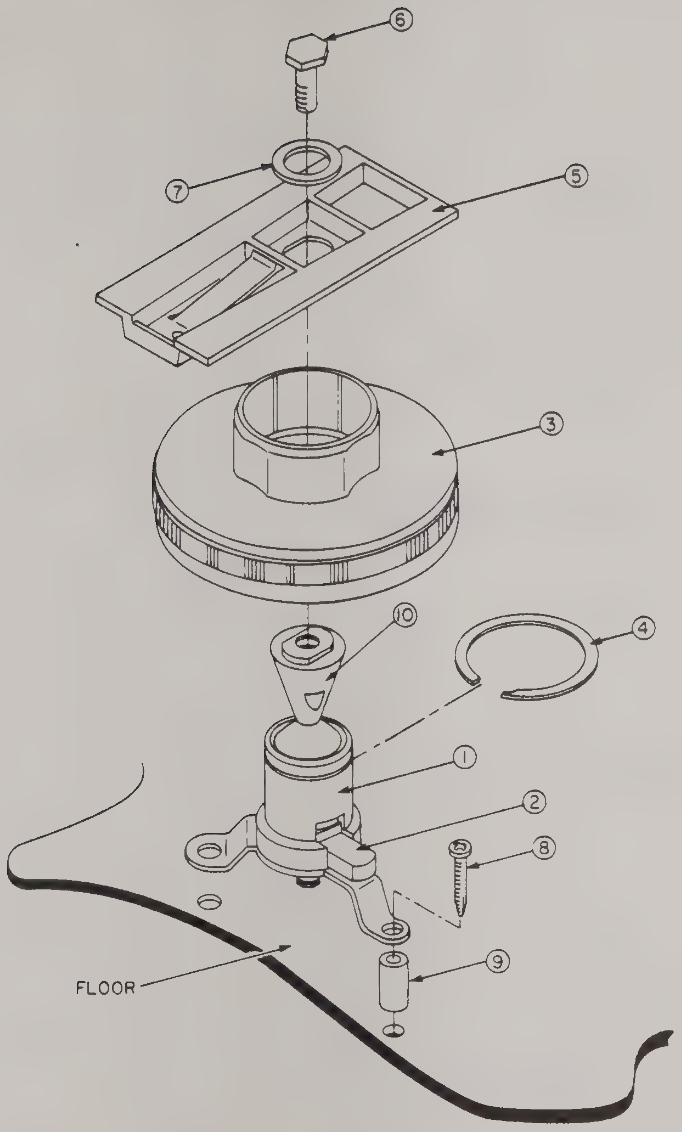
2.03 Install pedestal mounting assembly as follows. (see figure 2-2.)

(a) Locate desired mounting surface and use pedestal base (1) as a template. Drill three holes (No. 21 bit) as marked on mounting surface. (0.159-inch or 5/32-inch)

(b) Secure pedestal base to mounting surface with three self-tapping screws (8) provided. The longer screws and spacers (9) should be used if the mounting surface is carpeted.

(c) Locate locking wedge (2). Tap the locking wedge in (towards center of pedestal base) so opposite end of wedge protrudes slightly (1/64-inch) from pedestal base.

(d) Slide locking skirt (3) down over pedestal base. Rotate locking skirt so that eccentric on underside slips over locking wedge (2). When wedge is engaged, slide skirt (3) down (rotate back and forth slightly) until retaining ring (4) can be slipped into groove on pedestal base.



INDEX NO.	DESCRIPTION	PART NO.
1	Pedestal base	6624-4102
2	Locking wedge	6624-4105
3	Locking skirt	6624-4111
4	Retaining ring	H-1741
5	Wedge mounting	6624-4107
6	Bolt, ⁵⁄₁₆-24 × ½-inch	H-6302
7	Flatwasher, ⁵⁄₁₆-inch	H-1287
8	Self-tapping screws:	
	1½-inch long	H-4844
	½-inch long	H-0539
9	Spacer (for 1½-inch screw)	1968-0730
10	Ball shaft	6624-4115

Figure 2-2. Pedestal Mounting

(e) Place wedge mounting (5) on ball shaft (10) and secure with bolt (6) and washer (7). Be sure flats on wedge mounting line up with flats on ball shaft. Use LOCTITE® on threads to prevent bolt from loosening.

NOTE

The ball shaft can be secured by rotating the locking skirt (either direction). This will assist in tightening the bolt (step e).

2.04 When the pedestal mounting (paragraph 2.03) is not practical, the wedge mounting (figures 2-3 and 2-4) may be installed on a flat mounting surface by using the following procedure:

(a) Select a mounting location with sufficient clearance to allow removal of the Cradle Assembly from the wedge.

(b) Use wedge mounting as a template; mark and drill two mounting holes (No. 21 drill bit). (0.159-inch or 5/32-inch)

(c) Secure wedge mounting to mounting surface using self-tapping screw provided. Spacers may be needed if surface is carpeted.

2.05 Install Cradle Assembly as follows:

(a) Position wedge plate (figure 2-3) as required and secure with four 6-32 screws supplied (part No. H-3047).

(b) Slide cradle/wedge plate assembly onto wedge mounting (5, figure 2-2) until spring finger (figure 2-3) engages slot in wedge plate.

(c) If using a pedestal installation, position Cradle Assembly as desired and lock by rotating locking skirt (3, figure 2-2) in either direction.

NOTE

To remove cradle/wedge plate assembly from wedge mounting, depress spring finger with release tool (6624-4116), a knife blade or similar object (figure 2-5). The Cradle Assembly, including release tool, can now slide off of wedge mounting.

3. ELECTRICAL CONNECTIONS

A. Transceiver

WARNING

In mobile installations, SEVERE DAMAGE to the vehicle may result from improper fuse location or lack of fusing. Any wires connected to the positive battery terminal MUST BE FUSED AT THE BATTERY.

NOTE

To prevent the possibility of accidental short circuits from occurring when installing the power cable, disconnect the ground strap from the vehicle battery.

3.01 As an aid in reducing or preventing engine noise from being introduced into the Transceiver through the primary power cable, and to ensure full Transmitter output, primary power must be obtained directly from the vehicle battery as shown in the electrical connection diagram, rather than the vehicle ignition switch or some other point. The red lead of the primary power cable must be connected to the positive (+) battery terminal and the brown lead must be connected to the negative (−) terminal. The primary power fuseholder and 15 ampere fuse must always be in the red, ungrounded, primary power lead at the battery. Where cables are routed through the fire wall or other partitions, avoid sharp bends and use a rubber grommet to prevent chafing or cutting of the cable.

(a) Referring to figure 2-6, route power cable from trunk compartment to engine compartment.

(b) Securely connect power and control cables to connectors on Transceiver front panel.

(c) Secure white ground wire to vehicle near Transceiver. Remove all finishes to bare metal to ensure that there is a good electrical connection between vehicle and ground wire. Use caution when drilling to prevent vehicle damage.

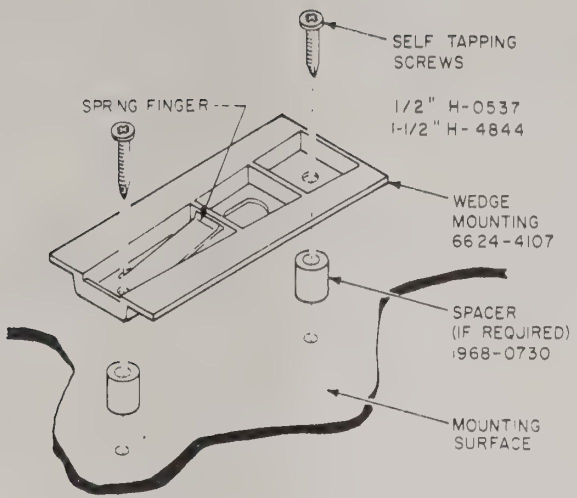


Figure 2-3. Flat Mounting

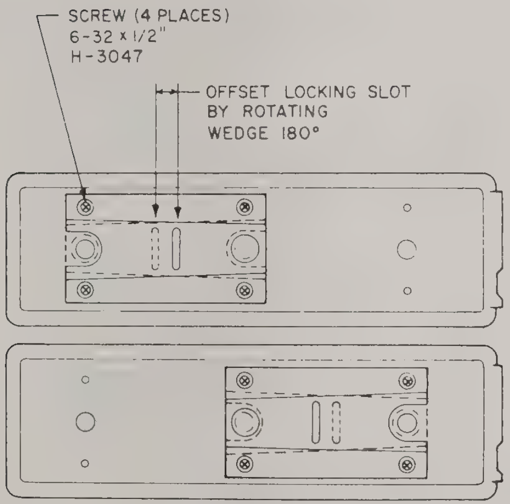


Figure 2-4. Wedge Plate Mounting

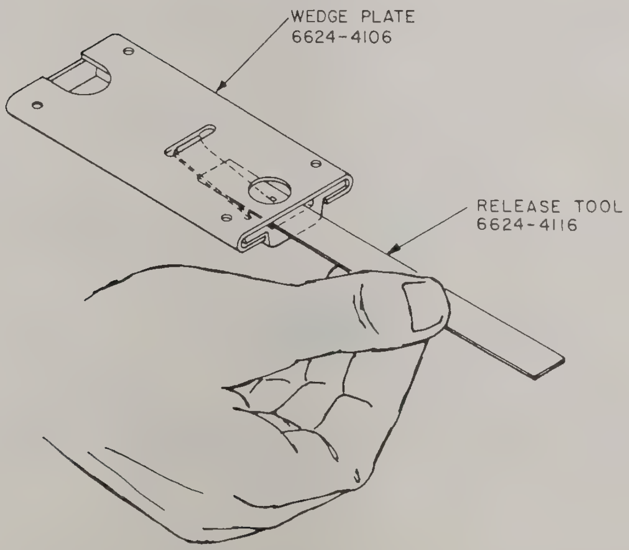


Figure 2-5. Removal of Mounting Plate

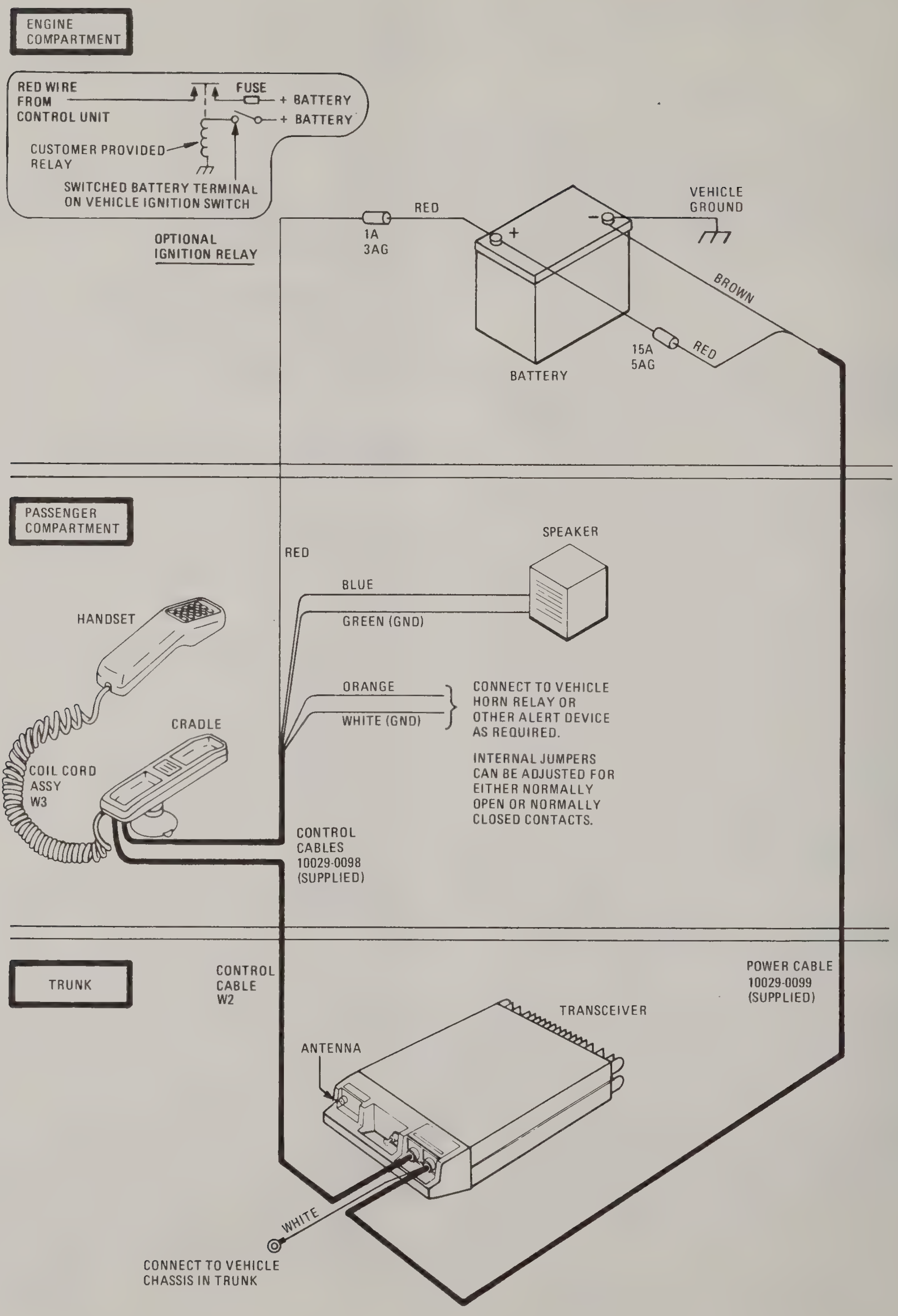


Figure 2-6. Electrical Interconnection Diagram

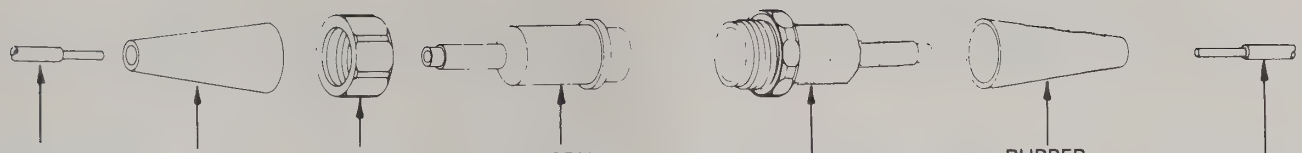


Figure 2-7. Transceiver Power In-line Fuseholder Assembly Diagram

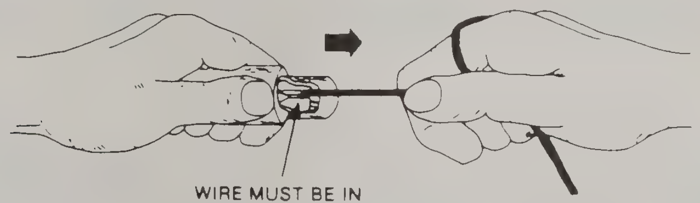
Step 1

A. Thread wire through each housing.

B. Loop wire into terminal — end must be FLUSH.

Step 2

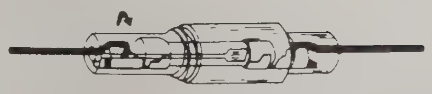
Holding housing, pull each wire into terminal slot until stop is reached.



Step 3

A. Insert fuse.

B. Screw housing together lightly.
Do not over tighten.



RF Part No. F01-0005-000 (AMP Tool-less Fuseholder)

Figure 2-8. Alpha 40 In-line Fuseholder Assembly Diagram

(d) To install primary power in-line fuseholder (5AG), cut red lead about 18-inch back from battery and assemble fuseholder to the wires as shown in figure 2-7.

(e) Connect 18-inch long red lead to positive (+) battery terminal.

(f) Route brown lead of power cable to negative (−) battery terminal and connect lead to battery.

(g) Using instructions in figure 2-10 fabricate antenna cable/connector assembly.

B. Control Unit

CAUTION

While making electrical connections, disconnect the battery ground strap at the battery to prevent accidental short-circuits.

NOTE

The Control Unit fuse is located inside the Cradle, but it is recommended that another fuse be installed at the battery to protect against shorts in the red power wire.

3.02 Route and install Control Cable per paragraph 2.02.

3.03 Individual installations will determine which of the following wiring methods are appropriate.

Direct Battery Operation (Recommended)

3.04 This wiring method must be used when either the external alerting feature or the theft alarm unit is to be utilized. This method will also reduce possible engine noise pickup in the Control Unit.

(a) Route red wire from W2 (of the Cradle) through vehicle fire wall. Use rubber grommet if necessary.

(b) Connect red wire to positive terminal of vehicle battery. Cut red wire approximately one foot from battery and install fuseholder as shown in figure 2-8.

Ignition Switch Control Desired

3.05 Connect red wire from W2 (of the cradle) to the vehicle ignition switch (accessory or auxiliary position). If this wire must pass through the fire wall, insert fuseholder in this line as described in paragraph 3.04 (b). If ignition/regulator/alternator noise is a problem, connect red wire to battery through a relay operated by ignition switch as shown in figure 2-6.

External Alert Signal (Vehicle Horn)

3.06 Use the procedure outlined in paragraph 3.04 for primary power wiring for the Control Unit. The alert signal circuit in the Cradle comes from the manufacturer with only JMP 1 in place so that relay K1 is set for normally-open operation. See figure 2-9. JMP 2 should be installed and JMP 1 removed if normally-closed operation is desired.

(a) Connect white and orange wires of cable W2 as illustrated in figure 2-9.

(b) If RF-4940-02 Theft Alarm Unit is to be used, disregard step (a) and follow the instructions provided in the Theft Alarm Manual.

External Speaker

3.07 Connect one end of RF-4940-01 external speaker cable into 2-pin connector on cable W2 from Cradle Assembly.

Cable Drawings

3.08 Refer to figures 2-11 and 2-12 for the connector pin functions.

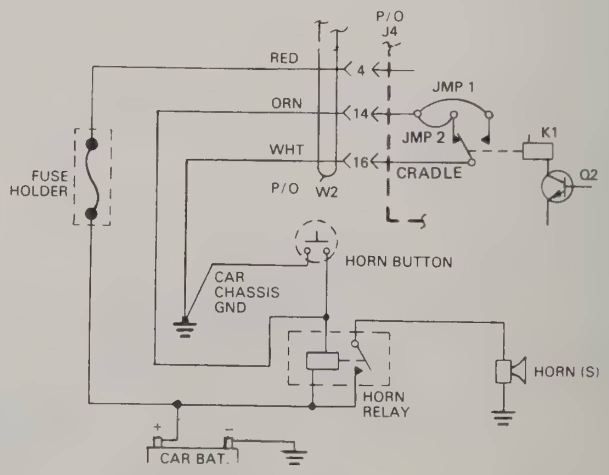
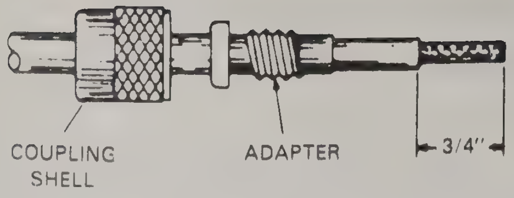
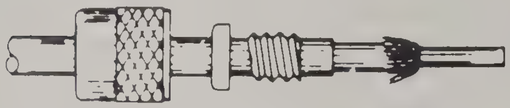


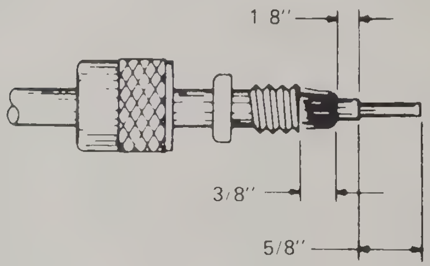
Figure 2-9. External Alert Wiring Diagram



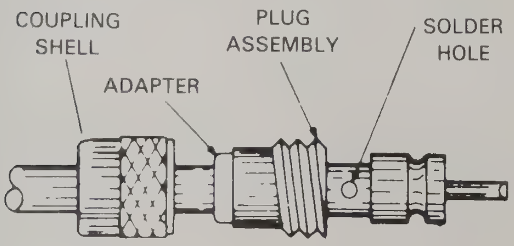
1. Cut end of cable square. Remove 3/4" of vinyl cover, don't nick braid. Slide coupling shell and adapter onto cable.



2. Fan braided shield and fold back over cable as shown.



3. Position adapter and press braided shield down over adapter as shown and trim braided shield to 3/8". Expose 5/8" of center conductor and tin.

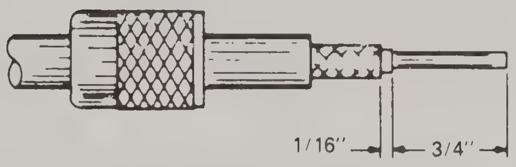


4. Screw plug assembly onto adapter. Solder braided shield to plug assembly through solder holes. Solder center conductor to plug assembly center contact.

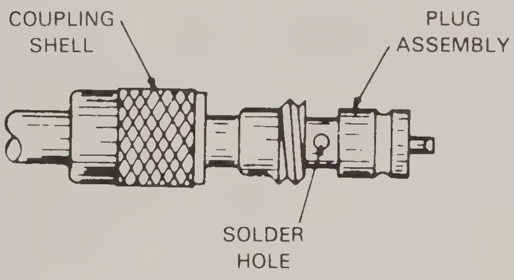
5. Screw coupling shell onto plug assembly.

PL-259 PLUG AND RG-58/U
COAX CABLE FABRICATION

1. Cut end of cable square. Remove 1 1/8" of vinyl cover, don't nick braid.



2. Bare 3/4" of center conductor insulation, don't nick center conductor. Trim 1/16" of braided shield and tin braided shield. Slide coupling shell on cable.



3. Screw plug assembly onto cable. Solder plug assembly to braided shield through solder holes. Solder center conductor to plug assembly center contact.

4. Screw coupling shell onto plug assembly.

PL-259 AND RG-8/U COAX
CABLE FABRICATION

Figure 2-10. Antenna Coax Cable/Connector Assembly Diagram

4. POST-INSTALLATION CHECKS

4.01 Before operation, the Transceiver must be checked out, and adjustments made, if required. Refer to figure 2-13 for the post-installation procedures. Refer to figures 2-14 and 2-15 for the adjustment procedures.

4.02 In vehicles equipped with an electronic antiskid braking system or electronic fuel injection system, the following road test must be performed to ensure that there is no interference with these systems when the Transmitter is keyed.

(a) Set parking brake and place transmission selector in neutral. With engine running at a high idle speed, key Transmitter, with and without voice modulation. Do not depress brake pedal. Repeat keying with brake pedal depressed.

(b) Allowing a minimum of three car lengths in front of vehicle for safety, apply brake pressure sufficient to prevent forward motion. Release parking brake and place transmission in drive keeping the engine at a fast idle. Key Transmitter with and without modulation. If interference exists, engine may run erratically (vehicle may move forward, brake lights may behave erratically or an abnormal audio signal may be heard).

(c) At a speed not exceeding 25 mph, key Transmitter with and without modulation. Maintaining a speed of 25 mph with foot resting lightly on brake pedal, key Transmitter with and without modulation.

(d) At a speed not exceeding 30 mph, moderately decelerate vehicle using foot brake while keying Transmitter with and without modulation.

4.03 The brake and fuel injection systems will, in most cases, function normally. If any malfunction exists during the road test, an alternate location for the Transceiver and associated cables will be required. In some cases, the use of a double shield coaxial cable will eliminate interference problems.

5. NOISE INTERFERENCE

A. General

5.01 Man-made interference emanating from engine ignition systems, voltage generating systems, and other electrical devices, if predominant, will be heard in the speaker in the form of popping, whining, hissing or crackling noises. The sources and more common methods of suppressing these noises are explained in the following paragraphs.

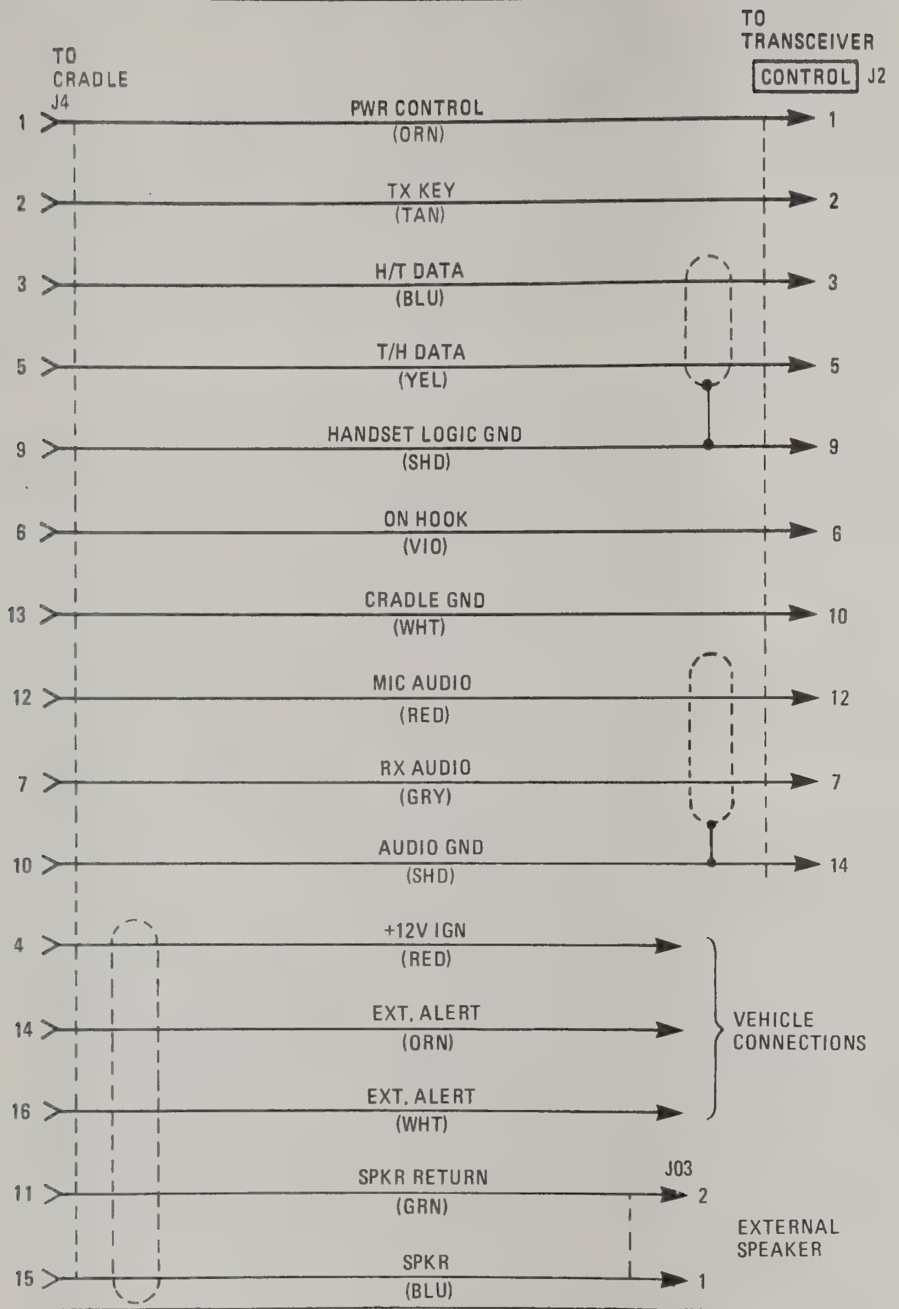
5.02 Complete ignition noise suppression kits are available for use on most vehicles. These kits usually consist of shielded ignition wires and special shields for the spark plugs, ignition coil, and distributor. However, the use of these kits must be undertaken with caution as engine performance may be adversely affected.

5.03 In some cases the use of braided bonding straps will greatly reduce interference. However, it is suggested that these bonding straps be used at all times and must be connected to form a common connection between the engine exhaust pipe, engine block, generator/alternator frames, voltage regulator cover, the ground side of the battery, and all instrument cases. All engine parts such as valve covers that are separated from the engine block by gaskets, should be connected to the engine block with bonding straps. Also remove all paint and grease from surfaces that are bolted together to ensure good electrical contact.

5.04 Additional information on noise suppression is contained in the Automotive Service Manual, Form 7K; and Giving Two-Way Radio its Voice, Form 7R. These can be obtained from Automotive Technical Services Dept., Champion Spark Plug Company, P.O. Box 910, Toledo, Ohio, 43601.

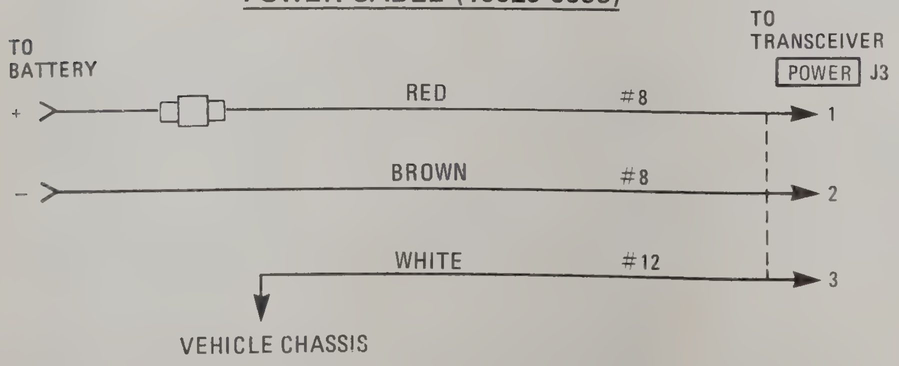
5.05 Ignition noise suppression kits can be obtained from Hallet, 136 N. Ash St., Inglewood, California, 90301. The coaxial capacitors and resistor spark plugs mentioned in the following paragraphs can be obtained through any automotive dealer.

CONTROL CABLE (10029-0098)



Qty	Description	RF P/N
23 feet	Cable, 8 Conductor	W-1894
1	Connector, 14-pin	J15-0004-000
1	Connector, Hood	MP-4162
1	Connector, Collar	10029-0061
10	Contact, Male	MP-1255
1	Connector, 16-pin	P-0565
16	Contact, Female	MP-1196
10 feet	Cable, 6-Conductor	W50-0005-006
1 P/O J03	Connector, 2-pin	J-0075
2 P/O J03	Contact, Female	MP-4237

POWER CABLE (10029-0099)



Qty	Description	RF P/N
23 feet	Cable, Power	W80-0007-000
1	Connector, Power	P-0257
1	Connector, Hood	MP-1272
1	Connector, Collar	10029-0061
2	Socket, 8-10 Gauge	MP-3556
1	Socket, 12 Gauge	MP-3557
2 feet	Wire, 12 Gauge	W-1094
1	Fuseholder	X-0728
2	Boot, Fuseholder	MP-3553

Figure 2-11. Control and Power Cables

Qty	Description	RF P/N
1	Cord, Coil	6624-1301
2	Connector, 11-pin	P-0567
22	Contact, Female	MP-0525

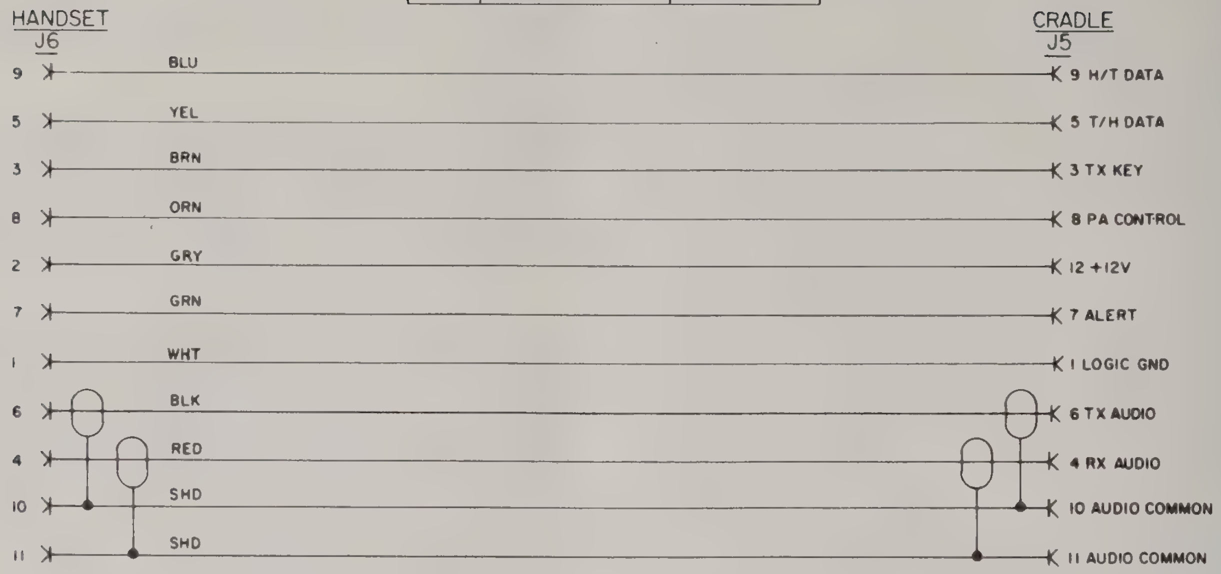


Figure 2-12. Handset-to-Cradle Cable (6624-1300)

B. Ignition System

5.06 Noise generated by the ignition system will appear as a popping sound in the speaker and when the ignition switch is turned off, with the engine running at a high idle speed, this noise will immediately disappear. This type of interference may be reduced through the use of resistor-type spark plugs and by installing a 0.1 mfd coaxial capacitor in series with the ignition coil primary lead, NOT the coil-to-distributor lead. This capacitor should be as close as possible to the coil. Shielded ignition kits can also be used, but should be used with the caution previously mentioned.

C. Generator and Alternator

5.07 This type of interference is characterized by a high pitched whine that does not immediately stop when the ignition switch is turned off with the engine running at a fast idle. Make sure that the generator commutator and alternator slip rings are clean, and that the brushes are in good condition and making proper contact. At the generator/alternator armature terminal, install a 0.5 mfd coaxial capacitor in series with the armature lead. Make sure that the area of contact between the capacitor body and generator/alternator frame is clean and that the capacitor is securely fastened. Install metal braid shielding on the field and armature leads between the generator and voltage regulator. Ground both ends of the braid.

D. Voltage Regulator

5.08 The voltage regulator can produce a ragged, rasping sound that does not immediately stop when the ignition switch is turned off with the engine running at a fast idle, this source is usually heard in conjunction with generator/alternator whine. Install 0.20 mfd coaxial capacitors in series with the battery and armature leads at the voltage regulator. Make sure that the capacitor bodies are well grounded. Do not install capacitors in the field lead.

E. Instrumentation

5.09 Noise generated by engine instruments is usually in the form of a hissing or crackling sound. Gauges employing rheostats are likely to produce the most trouble. A low-pitched clicking sound is generally caused by the oil pressure sensor. The clicking rate will vary as the oil pressure varies with engine speed. The offending gauge or gauges can be isolated by disconnecting the hot leads from the gauges and then reconnecting the leads one at a time, to their respective gauge. After the lead is reconnected, jar the gauge. If noise is heard, connect a 0.25–0.50 mfd capacitor between the hot lead and ground.

F. Environmental Noise Generators

5.10 A less obvious, but increasingly problematic interference source, especially with regard to vehicular duplex radios, is noise generated by non-linear resistance junctions within the vehicle itself. The following information is included at this point so that problem interference from this source can be recognized and intelligently addressed, with the solution being elimination of the non-linear interference generating sources from within the vehicle.

5.11 General information in this problem area cannot be ''assumed,'' and as a consequence, the following general background information is included. Consider that an automobile consists of a large number of mating metallic parts held together by various means. When the vehicle is in motion, many of these metallic parts move or vibrate independently in relation to each other. This movement creates a number of intermittent contacts within the vehicle. If the metallic parts are illuminated with radio frequency energy from a nearby transmitter, these intermittent contacts become non-linear interference generators. These natural (environmental) nonlinear sources have a voltage-current characteristic curve similar to a pair of parallel front to back diodes. The non-linear interference generators re-radiate energy, received from the transmitting source, as a low level broadband energy field. Any receiving antenna, located in close proximity to these interference generators, will pick-up this broadband energy and apply it to the receiver. The selectivity of the receiver will attenuate most of the interfering energy, however, no protection in the receiver is possible for that portion of the energy spectrum which falls directly on channel. This interfering energy competes with the desired signal for capture of the receiver. It should be noted, that the interference mechanism is not radio generated but is a direct function of the environment in which the radio is operating.

5.12 On equipment test have identified the following as primary non-linear interference generators:

- Loose chrome strips
- Seat springs
- Hood and trunk lids and locks
- Exhaust systems and mounts
- Bumper mounts
- Leaf or coil springs
- Tailgates on pick-up trucks
- Tool boxes mounted on the bed of pick-up trucks

5.13 The following conditions **must** be present for non-linear junction source noise to occur. By systematic control of these conditions, the problem can be identified and eliminated:

- First, the receiver must be operating in the presence of high level radio frequency energy within approximately 20 MHz of the receive frequency.

- The transmitter supply illuminating energy to the non-linear junction must be located in close proximity to, or on the same vehicle.

- The vehicle must be operated in a marginal signal area (approximately 25dB quieting or less) since the interference is usually at low levels.

- There must be motion or vibration to create the phenomenon (interference).

5.14 The following tests are suggested as an aid in identification.

- The vehicle should be operated in the area where the problem is occuring or in an area where the problem can be reproduced reliably.

- The base station transmitter should be turned on to provide a signal to quiet the receiver. The modulation lines to the base transmitter should be AC shorted to prevent any feedback paths in the system between the mobile and base.

- The suspected mobile transmitter should be keyed and unkeyed repeatedly while the vehicle is standing motionless. In some extreme cases, it may be necessary to also turn the vehicle motor off. If receiver interference occurs under these conditions, some other problem exists such as normal duplex desense (receiver interference caused by excessive on-channel transmitter sideband noise).

- Repeat the previous step with the vehicle in motion. If receiver interference occurs only when the transmitter is keyed, environmental interference is the cause.

5.15 Correcting the problem involves elimination of the non-linear interference source. Consider the following: Antenna mounts and the general installation should be examined for intermittents (including cable connections). The antenna should be located in such a manner so as to minimize energy radiated into the vehicle (this is usually the vehicle roof). Grounding straps should be positioned across suspected chassis members. It is important to note that interference can be generated by a radio frequency intermittent as well as a DC intermittent. Two metallic surfaces sliding across one another make effective non-linear sources. Chrome strips and other metal parts which approximate ¼ wave length are very efficient interference generators. There is no specific area which can definitely be predicted as a source. Each vehicle may be different and most vehicles will probably contain a number of sources. If these sources can be located and eliminated, the problem can be resolved.

5.15 Correcting the problem involves elimination of the non-linear interference source. Consider the following: Antenna mounts and the general installation should be examined for intermittents (including cable connections). The antenna should be located in such a manner so as to minimize energy radiated into the vehicle (this is usually the vehicle roof). Grounding straps should be positioned across suspected chassis members. It is important to note that interference can be generated by a radio frequency intermittent as well as a DC intermittent. Two metallic surfaces sliding across one another make effective non-linear sources. Chrome strips and other metal parts which approximate ¼ wave length are very efficient interference generators. There is no specific area which can definitely be predicted as a source. Each vehicle may be different and most vehicles will probably contain a number of sources. If these sources can be located and eliminated, the problem can be resolved.

NOTE

Unless otherwise indicated, the following steps apply to both the UHF and VHF Transceivers.

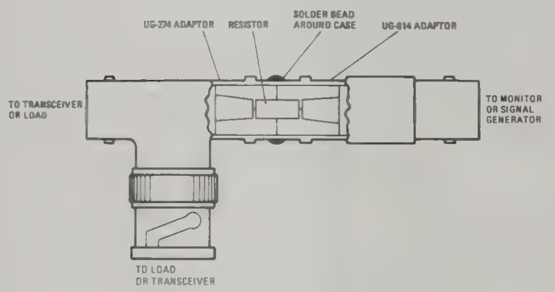
1. Check all cable connections.

NOTE

All of the following checks can be performed from the top of the Transceiver.

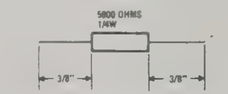
All dc voltages referenced to chassis unless otherwise specified. A 10029-0880 Test Board may be used at A8J4 to facilitate the following tests.

POWER ATTENUATOR

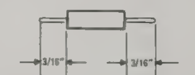


NOTES:

1. PREPARE RESISTOR BY CUTTING BOTH LEADS TO 3/8".

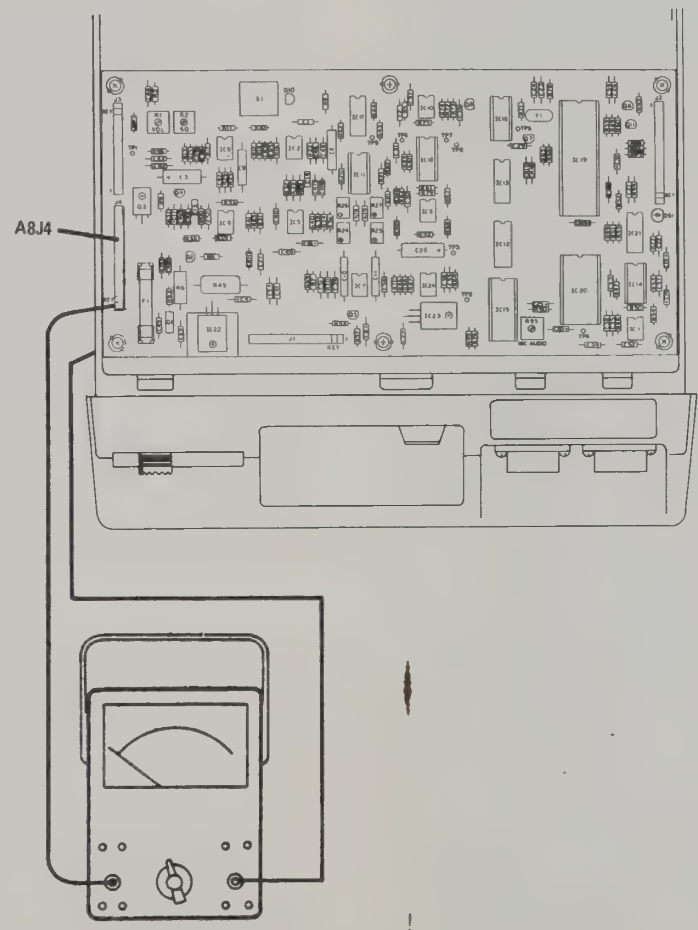


2. BEND BOTH LEADS OF RESISTOR 3/16" FROM THE BODY TO FORM A FLAT LOOP AT EACH END.



3. INSERT FORMED RESISTOR INTO ONE END OF A UG-274 ADAPTOR (FEMALE END).
4. INSERT THE OTHER END INTO ONE END OF A UG-614 ADAPTOR.
5. PRESS BOTH ADAPTORS TOGETHER UNTIL RESISTOR IS FULLY SEATED AND THE SHELLS OF BOTH ADAPTORS TOUCH.
6. SEAL THE JOINT OF BOTH CONNECTORS SHELL WITH A BEAD OF SOLDER.

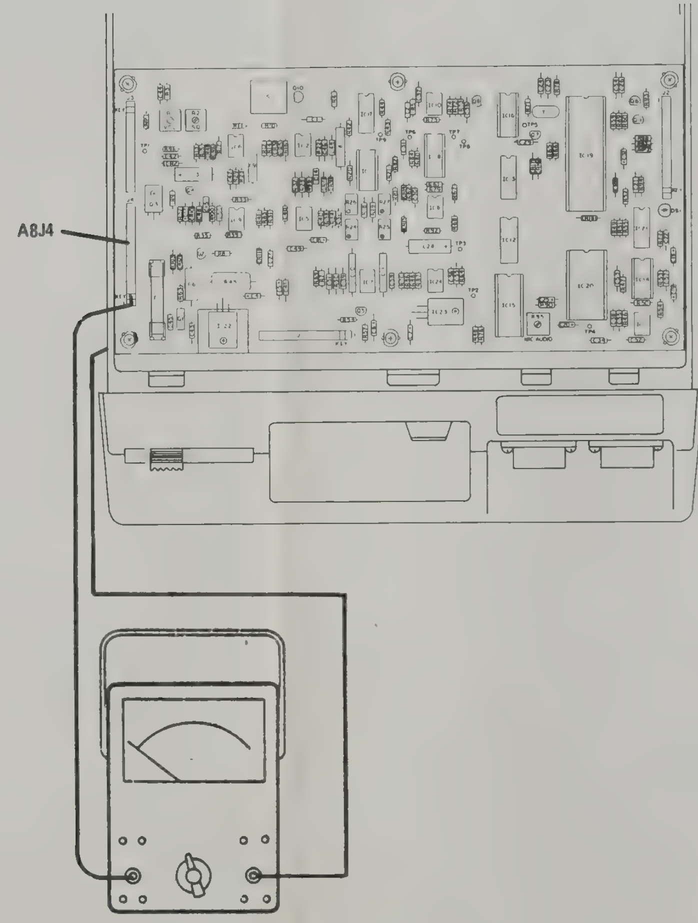
2. Check testpoint A8J4-3 for +13.6 volts dc minimum, +16.3 volts dc maximum with vehicle engine running.



3. Apply power at Control Unit.

4. At Control Unit, select A1 field and manual operation.

5. Check testpoint A8J4-4 for +13.6 volts dc (nominal).



6. At Control Unit, step through all channels and observe O/L indicator A8DS1. The indicator should not light.

7. Key Transmitter with Test Key A8S1 and observe O/L indicator A8DS1. Indicator may flash when first keyed, but should immediately go out. Check that actual channel frequency is within ± 100 Hz of the assigned frequency. Repeat for all channels.

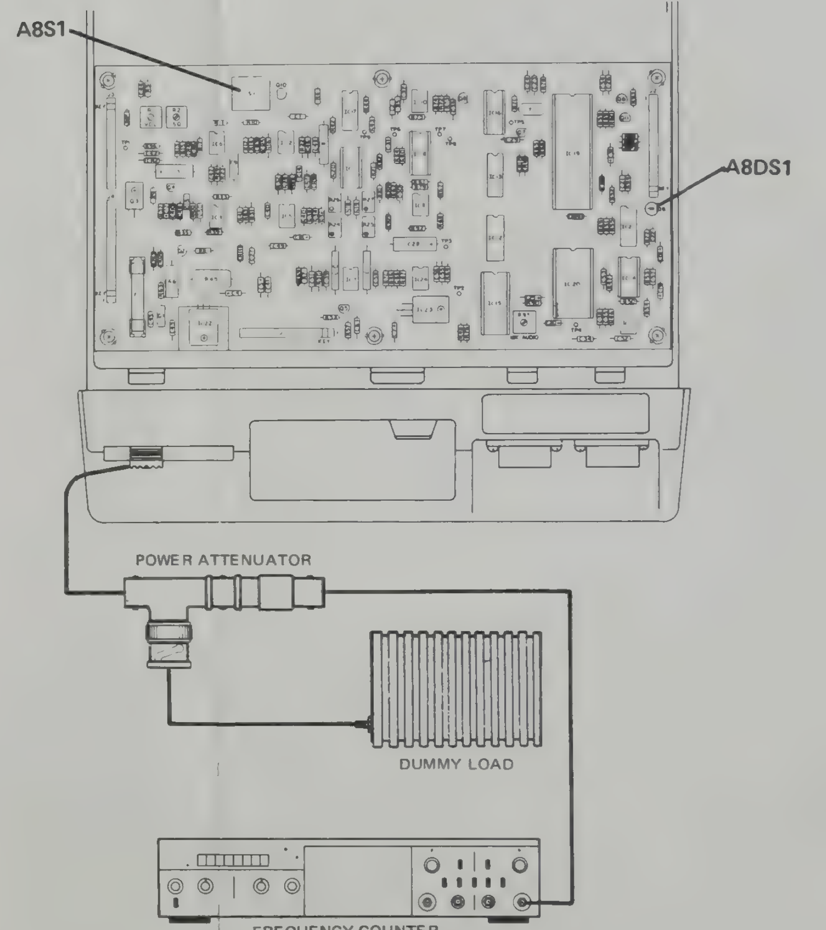


Figure 2-13. Post-Installation Checks (sheet 1 of 2)

!. Connect vehicle antenna to wattmeter as shown. :lect a channel. Key Transmitter. Reflected power om the antenna should be less than 15% of the forard power from the Transceiver. Unkey Transmitter. :peat for all channels. Reconnect antenna to ;ansceiver.

;. If any Transceiver operating parameter is out of ecification, refer to the adjustment procedures on ges 2-21 through 2-22.

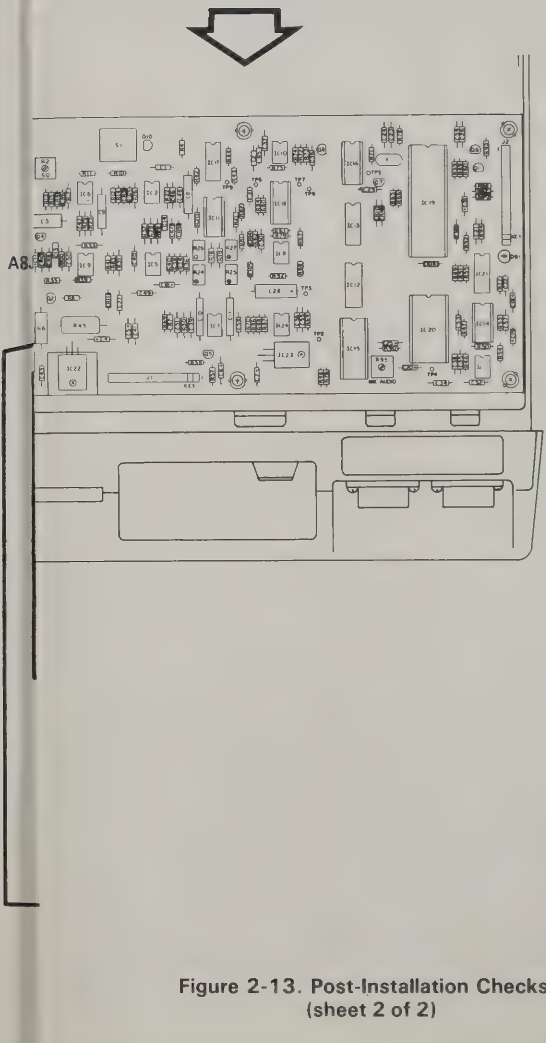
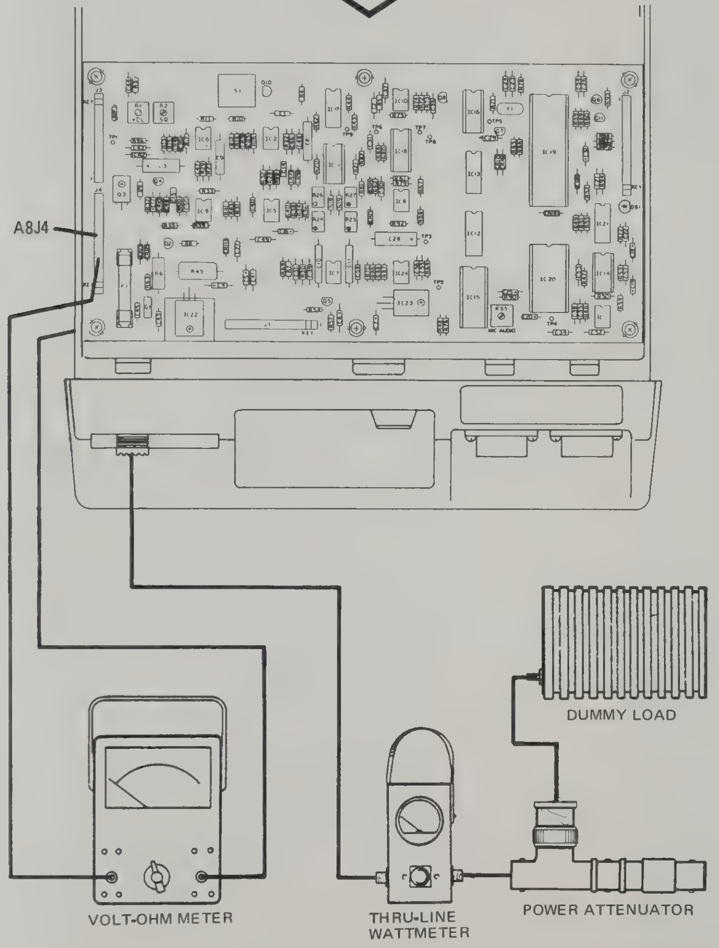


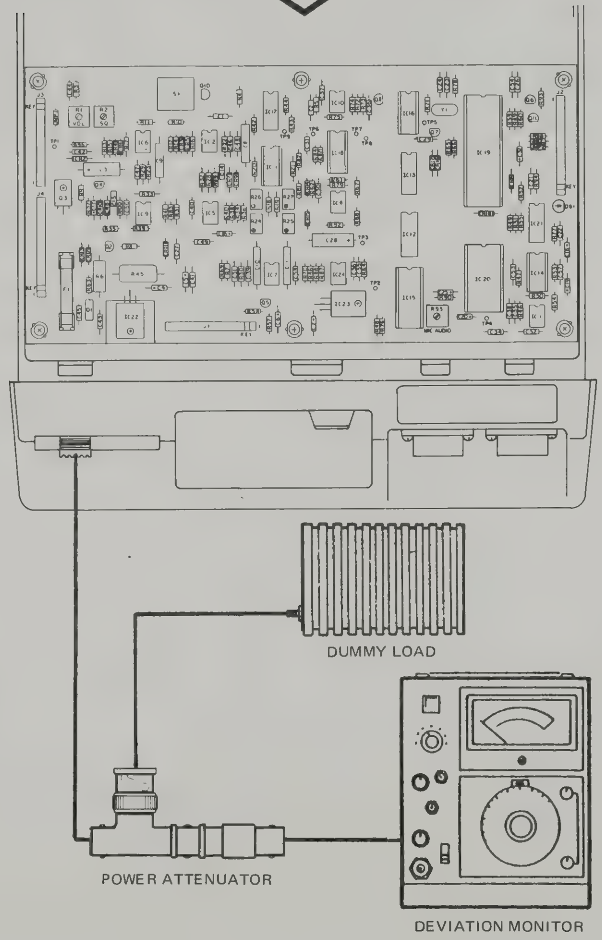
Figure 2-13. Post-Installation Checks (sheet 2 of 2)

8. Key Transmitter. Indication at A8J4-4 should be + 9.2 volts dc minimum. Unkey Transmitter.

9. Key Transmitter. Wattmeter should indicate 30 watts (nominal) for UHF or 50 watts (nominal) for VHF (unless Transceiver has been set for lower power output, 15 to 20 watts minimum). Unkey Transmitter.

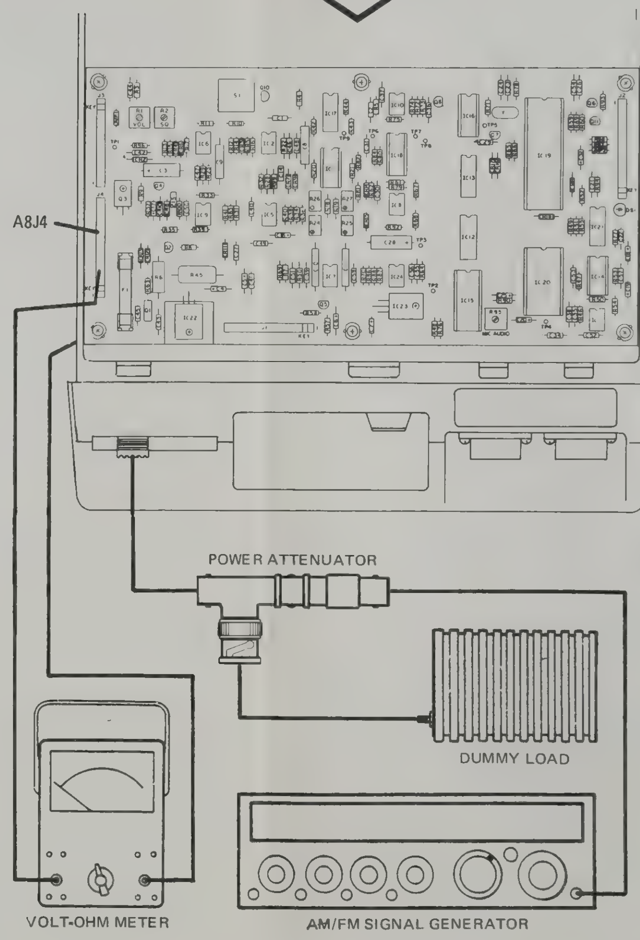


10. Key Transmitter. Whistle and talk loudly into handset microphone while observing Deviation Meter. Positive and negative peaks should not exceed 5 KHz. Unkey Transmitter.



11. a. A 1 KHz signal at 3.0 KHz deviation should produce 1.0 volt RMS audio signal at A8J4-6.

b. If FM Signal Generator is not available, connect antenna and step through channels until idle tone is found. The 2.0 KHz idle tone should produce ≈ 0.5 V RMS at A8J4-6.



12. Connect vehicle antenna to wattmeter as shown. Select a channel. Key Transmitter. Reflected power from the antenna should be less than 15% of the forward power from the Transceiver. Unkey Transmitter. Repeat for all channels. Reconnect antenna to Transceiver.

13. If any Transceiver operating parameter is out of specification, refer to the adjustment procedures on pages 2-21 through 2-22.

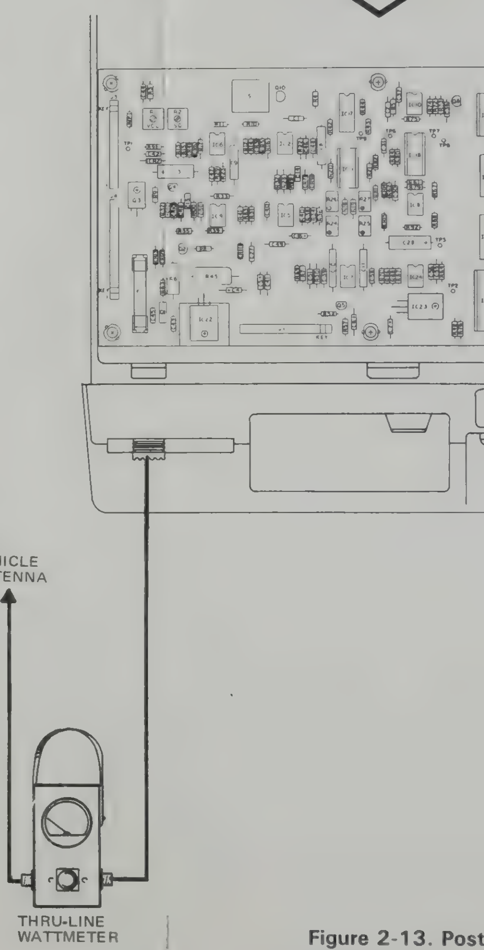


Figure 2-13. Post-Installation Checks (sheet 2 of 2)

NOTE

A special test mode is incorporated in the Control Unit. This test mode bypasses the access mode to enable the generation and monitoring of test tones. Repertory dialing is not operational during the test mode.

Step	Procedure
1	Connect Transceiver to dummy load capable of absorbing 50 watts.
2	Program A2 field for center channel.
3	Press [SEL] [MAN] pushbuttons and come off hook. The center channel number should appear on display.
4	Set Cradle ON/AUX/OFF switch in OFF position.
5	Enter Test Mode by simultaneously pressing [8] pushbutton and PTT bar while setting Cradle ON/AUX/OFF switch in ON position. Number 8 should appear on display.
6	Press [SND] pushbutton. Channel number for channel selected in step 2 should appear on display.
7	Press [RCL] pushbutton and then [7] pushbutton followed by pressing PTT bar. A 1 KHz tone should be transmitted over the selected channel for at least one minute. Repeating this step will cause another tone transmission. NOTE *When the test tone is being generated, no keyboard functions can be processed. Also, the test tone can be terminated at any time by going on-hook.*

Figure 2-14. Special Test Mode Procedure for Deviation Adjustment

VOLUME AND

Volume Control:

Squelch Control:

G VEHICLE ANTENNA

just trimmers A1C44 and A1C45 for maxim Wattmeter indication.

just trimmers A2C31 and A1C32 for maxim Wattmeter indication.

teps 3 and 4 until indication is within 5 perred power output.

urrent limiter control A2R23 until Wattmeter ust begins to decrease. Unkey Transmitter.

the vehicle antenna in place the dummy load Adjust antenna for best VSWR (follow inupplied with the antenna).

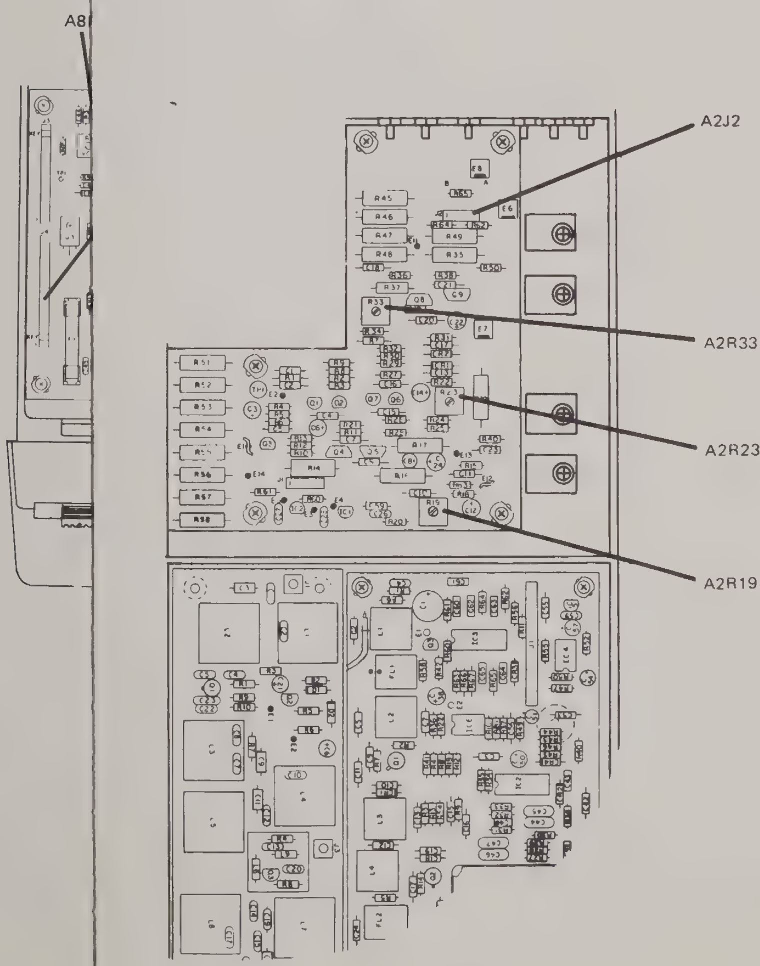
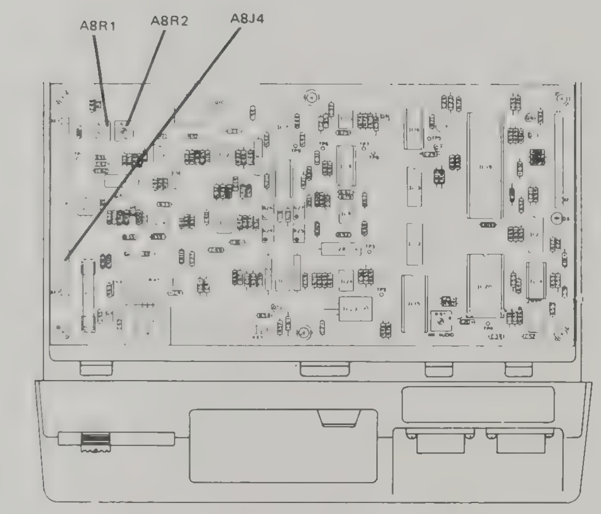


Figure 2-15. Post-Installation Adjustment Procedure

VOLUME AND SQUELCH CONTROL ADJUSTMENT PROCEDURE

Volume Control: Connect an FM Signal Generator through Power Attenuator to Transceiver Antenna Connector J1. Select a channel at the Control Unit, and adjust Generator for 50 mv minimum output with 1 KHz frequency modulation at 3 KHz deviation. Connect an AC coupled Audio Voltmeter from A8J4-6 to chassis. Adjust volume control A8R1 for indication of 1.0 VRMS. Refer to operator's manual (PM-1569) for instructions on adjusting earpiece volume.

Squelch Control: Referring to operator's manual (PM-1569) select manual operation at Control Unit. For Transceivers equipped with noise squelch, adjust A8R2 fully clockwise to disable noise squelch. Adjust noise squelch by rotating A8R2 counterclockwise until earpiece noise signal is eliminated.



DEVIATION AND CHANNEL FREQUENCY ADJUSTMENT PROCEDURES

1. Connect deviation meter and dummy load.

2. Set control A9R22 fully clockwise.

3. On Control Unit, enter test mode, select manual mode and center channel.

4. Press RCL 7 to generate 1 KHz test tone.

NOTE

When the test tone is generated, the Control Unit cannot perform any other keyboard operations. Test tone will automatically terminate after approximately one minute. Within that time, the test tone can be terminated by hanging up the handset.

5. Key Transmitter and set Transmitter deviation control A10A2R26 for 4.5 KHz deviation.

6. Depress hook switch to terminate test tone. Press PTT bar and whistle/speak into microphone. Average deviation should be between ± 3 and 3.5 KHz. If peak voice deviation is greater than 5 KHz, decrease A10A2R26 setting.

7. If average deviation is not within limits specified in step 26, adjust mic audio gain control A8R95.

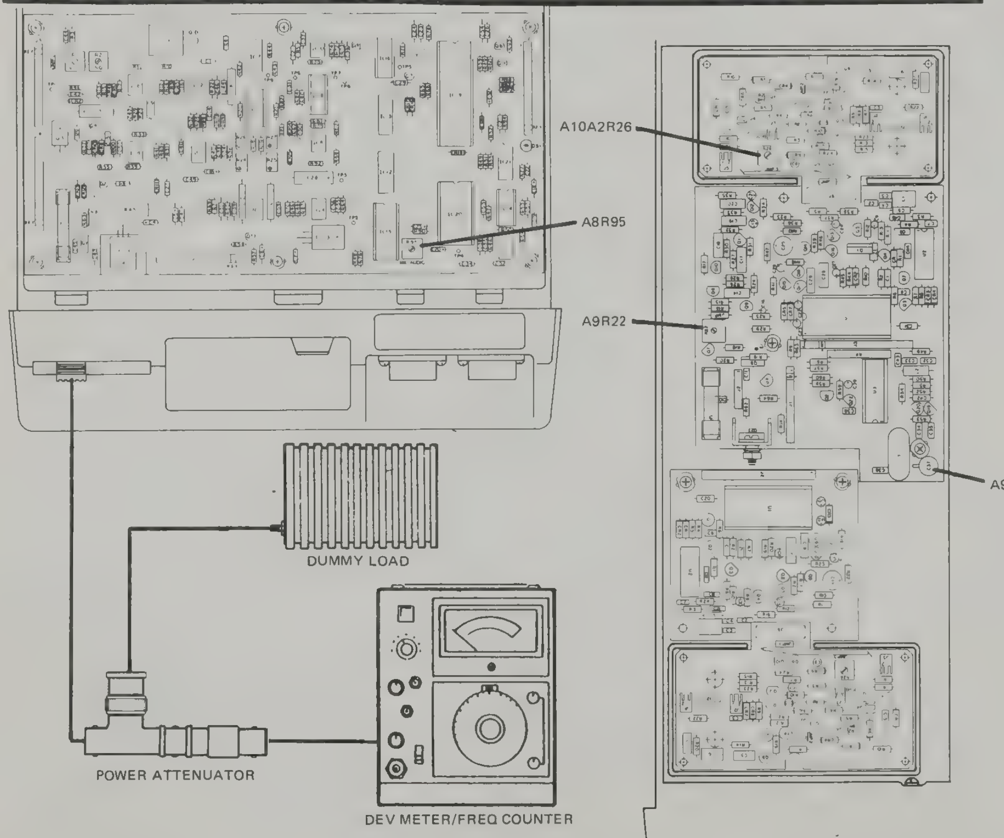
8. Disconnect test equipment.

9. Connect frequency counter through power attenuator to antenna connector J1.

10. Select manual mode and any channel.

11. Key Transmitter. Adjust trimmer A9C37 for Tx channel frequency (±.100 Hz). Unkey Transmitter.

12. Disconnect test equipment.



SETTING TRANSCEIVER RF OUTPUT/TRIMMING VEHICLE ANTENNA

1. Connect Wattmeter and dummy load to antenna connector J1. Connect DC Voltmeter to test point A1J2-2. Transceiver main supply voltage must be between 13.6 volts dc and 16.3 volts dc for this procedure.

2. Rotate A2R23 full clockwise.

3. Adjust power out control A2R19 for desired power output. (30 watts maximum UHF, 50 watts maximum VHF)

4. UHF:

Adjust trimmers A1C44 and A1C45 for maximum Wattmeter indication.

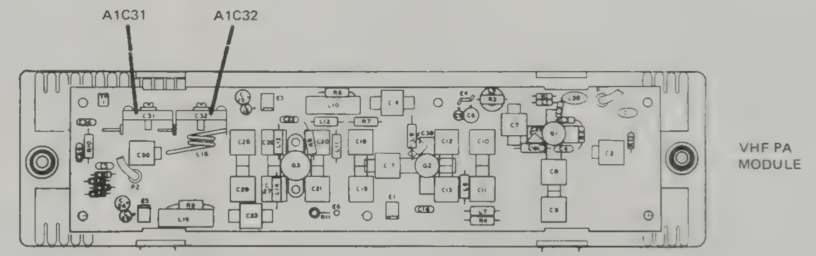
VHF:

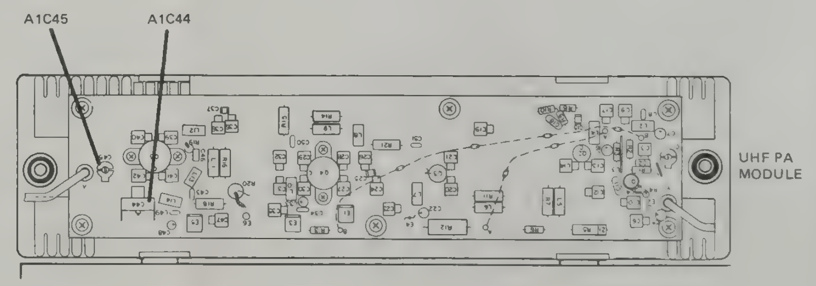
Adjust trimmers A2C31 and A1C32 for maximum Wattmeter indication.

5. Repeat steps 3 and 4 until indication is within 5 percent of desired power output.

6. Adjust current limiter control A2R23 until Wattmeter indication just begins to decrease. Unkey Transmitter.

7. Connect the vehicle antenna in place the dummy load in step 1. Adjust antenna for best VSWR (follow instructions supplied with the antenna).





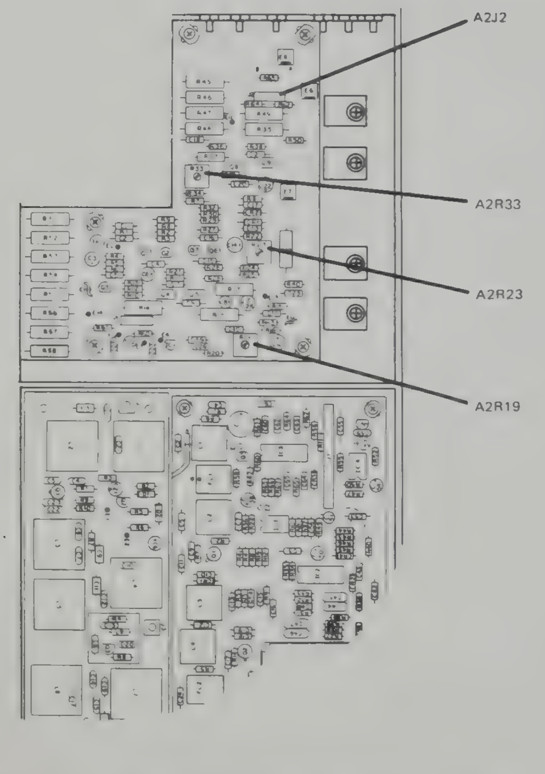


Figure 2-15. Post-Installation Adjustment Procedure

Chapter 3

PRINCIPLES OF OPERATION

TABLE OF CONTENTS

LIST OF FIGURES

ALPHA 2000 SERIES UHF/VHF MOBILE TELEPHONES

CHAPTER 3

PRINCIPLES OF OPERATION

1. INTRODUCTION

1.01 This chapter contains the principles of operation for the Transceiver. This information is presented in a pictorial manner which will be an aid in troubleshooting. There are five major functions—Receiver, Transmitter, Synthesizer, Interface Logic Board Control and Voltage Control. A separate diagram is provided for each of these functions. Key sub-functions are described on the diagrams. Schematic diagrams supporting these functional diagrams are located in the tabbed sections in this manual.

A

The receive
Front End
contains six
for transmi

After amplification the rf signal is passed through a 2-pole filter to mixer A4A1Q1. The tripled VCO output is mixed with the rf signal to produce an IF signal of 21.400 MHz.

B

The rf sig
amplifier
this stage

UHF

A

The received rf signal fr
Front End Module A4
Filter Module A11. The
cavities (two for receive

B

The rf signal is then pa
amplifier A4Q1. Auto
this stage. Transistor
control.

After amplification the rf signal is passed through a 3-pole filter to mixer A4Q3. The filtered VCO output is mixed with the rf signal to produce an IF signal of 21.400 MHz.

The 129.4 - 172.2 MH
being coupled to mixer

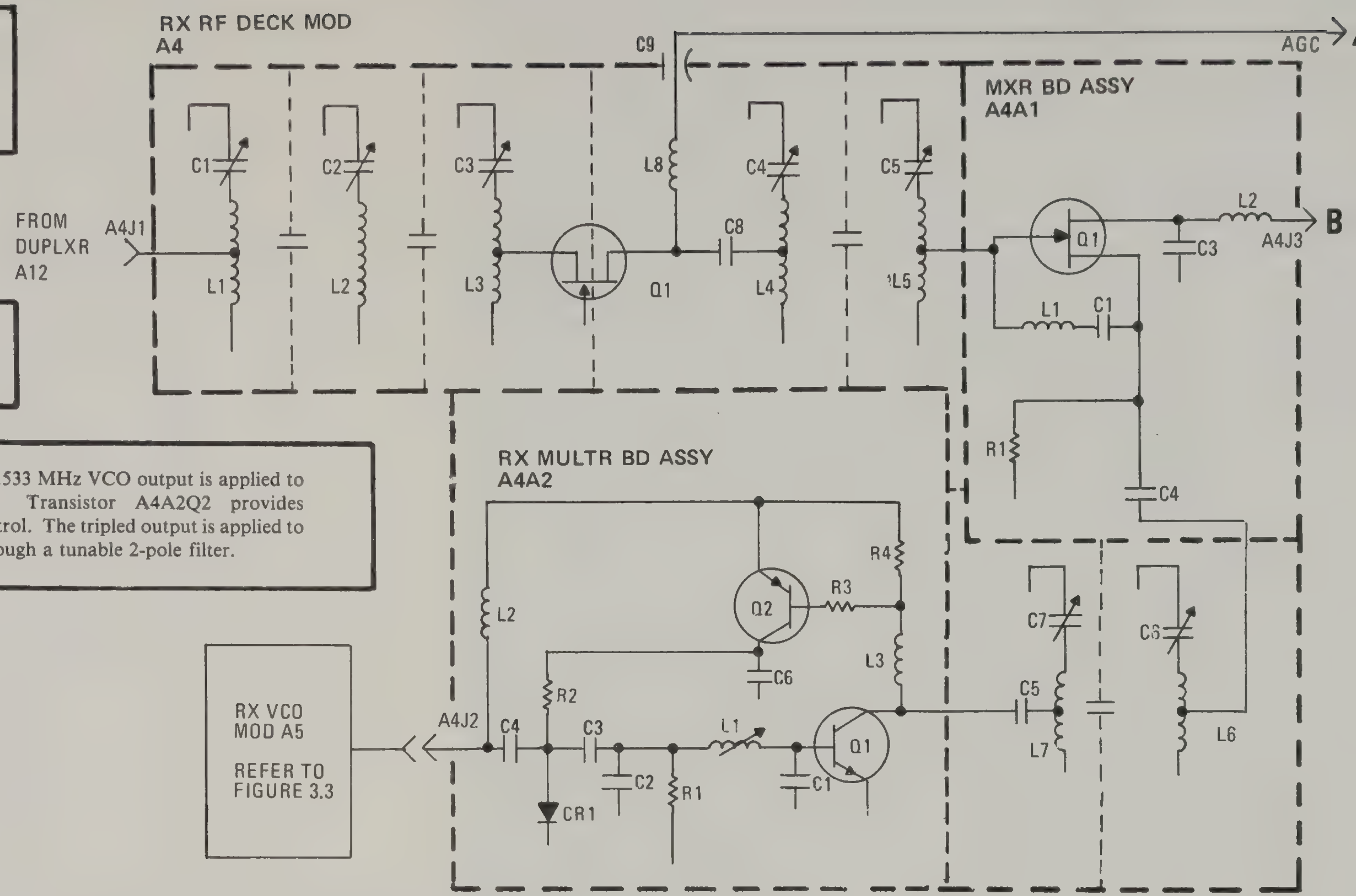
VHF

3-1. Receiver, Principles of Operation (Sheet 1 of 2)

The received rf signal from the antenna is coupled to Rx Front End Module A4 via Duplexer A12. The Duplexer contains six resonant cavities (three for receive and three for transmit).

The rf signal is then passed through a 3-pole filter to rf amplifier A4Q1. Automatic gain control is applied to this stage.

The 142.466 to 163.533 MHz VCO output is applied to tripler A4A2Q1. Transistor A4A2Q2 provides automatic level control. The tripled output is applied to mixer A4A1Q1 through a tunable 2-pole filter.

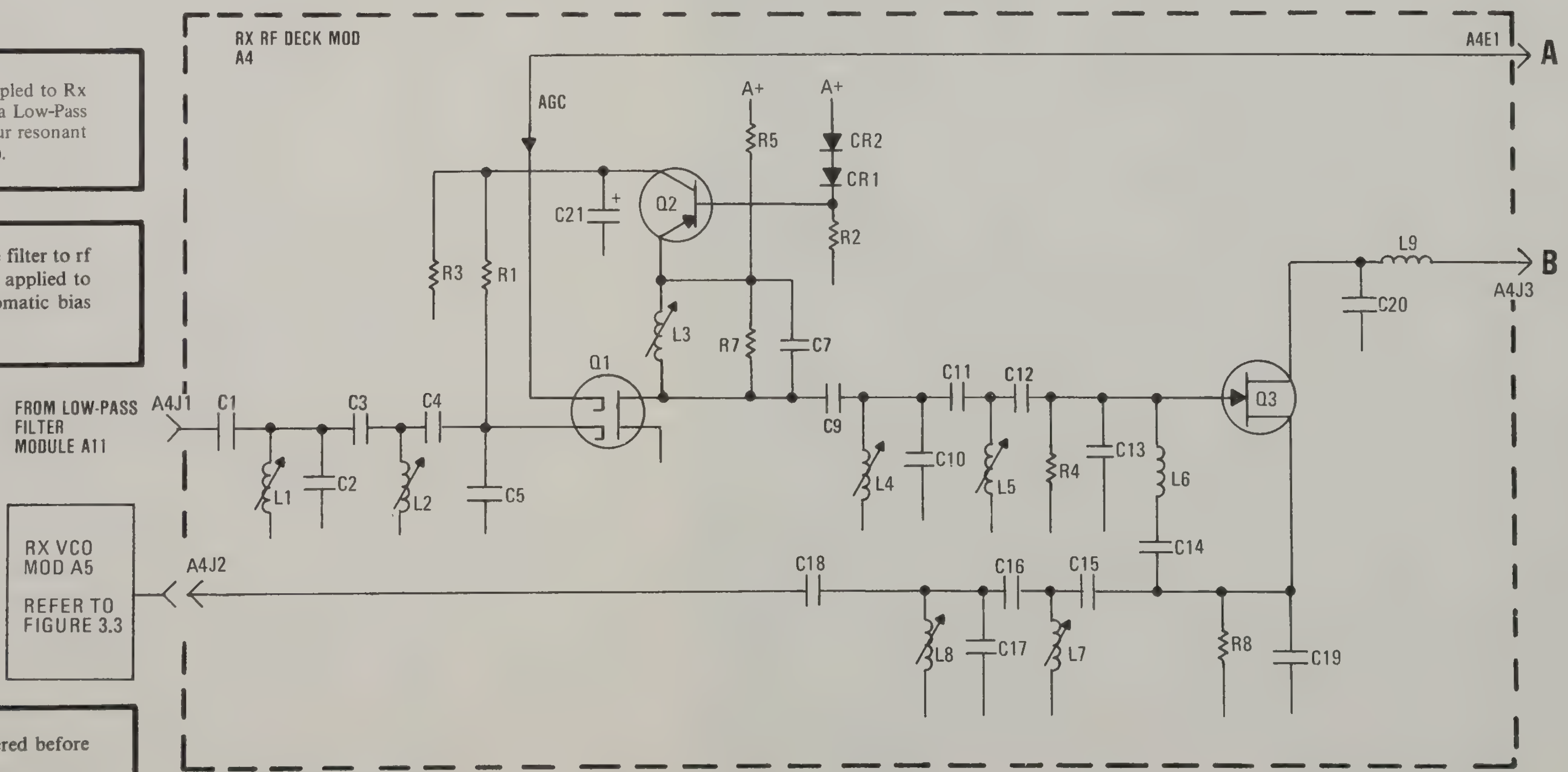


After amplification the rf signal is passed through a 2-pole filter to mixer A4A1Q1. The tripled VCO output is mixed with the rf signal to produce an IF signal of 21.400 MHz.

UHF

The received rf signal from the antenna is coupled to Rx Front End Module A4 from Duplexer A12 via Low-Pass Filter Module A11. The Duplexer contains four resonant cavities (two for receive and two for transmit).

The rf signal is then passed through a 2-pole filter to rf amplifier A4Q1. Automatic gain control is applied to this stage. Transistor A4Q2 provides automatic bias control.



After amplification the rf signal is passed through a 3-pole filter to mixer A4Q3. The filtered VCO output is mixed with the rf signal to produce an IF signal of 21.400 MHz.

The 129.4 - 172.2 MHz VCO output is filtered before being coupled to mixer A4Q3.

VHF

3-1. Receiver, Principles of Operation
(Sheet 1 of 2)

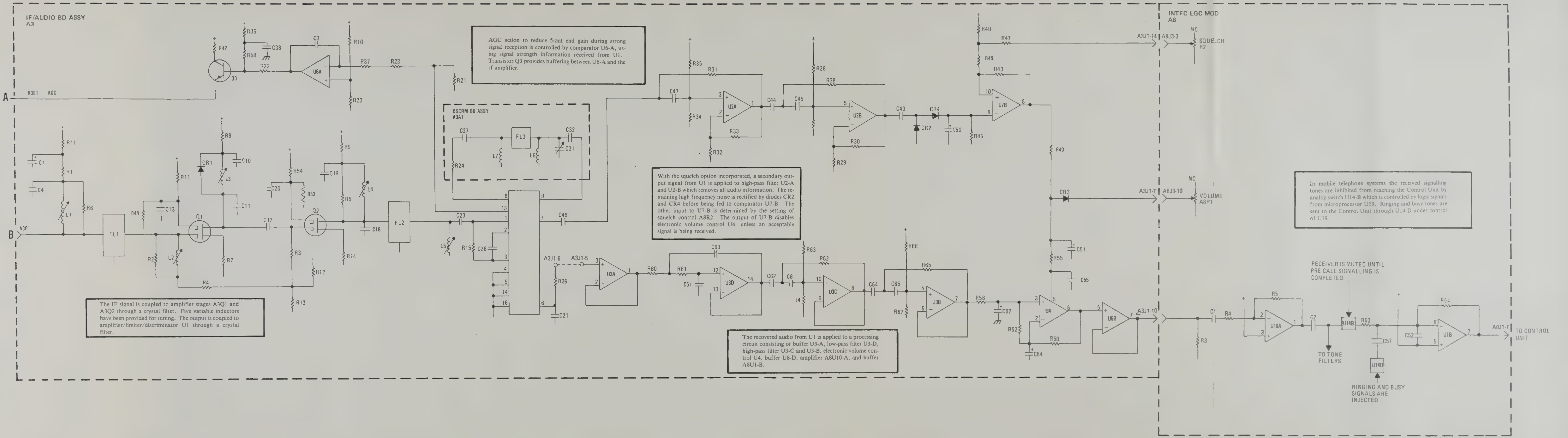


Figure 3-1. Receiver, Principles of Operation
(Sheet 2 of 2)

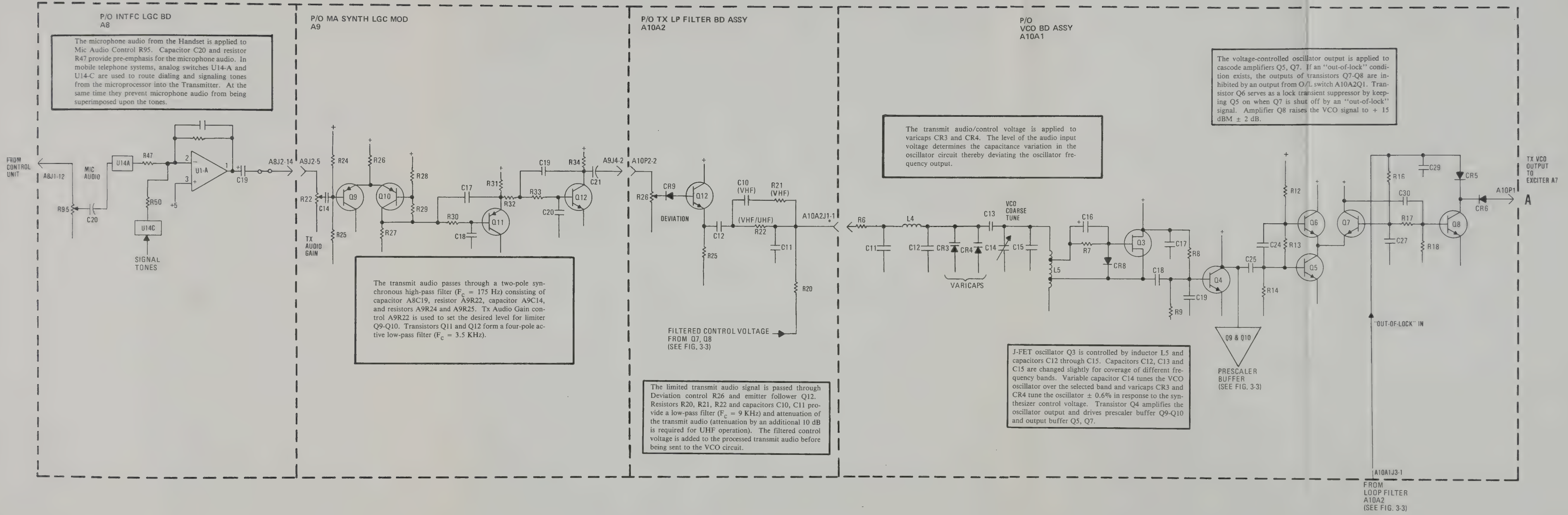


Figure 3-2. Transmitter, Principles of Operation
(Sheet 1 of 2)

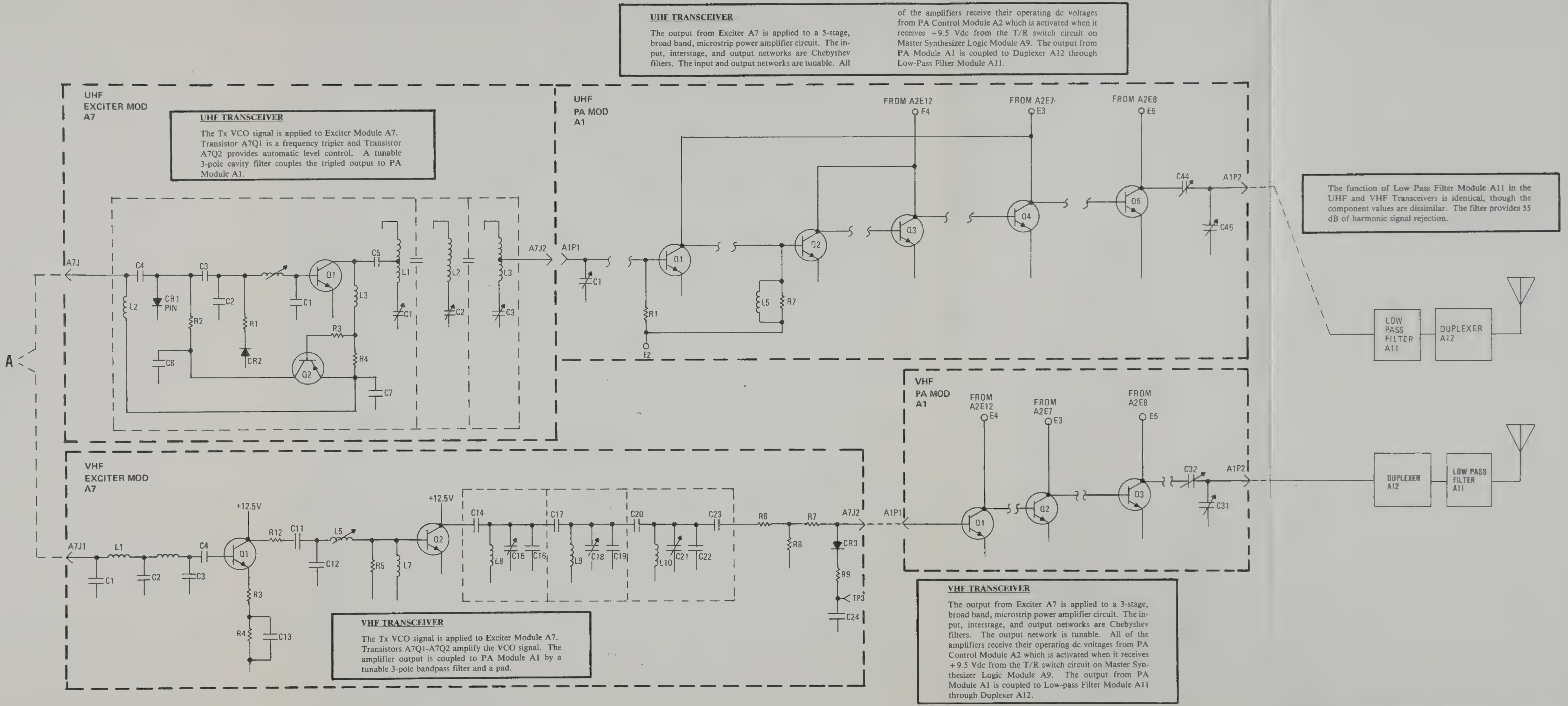


Figure 3-2. Transmitter, Principles of Operation (Sheet 2 of 2)

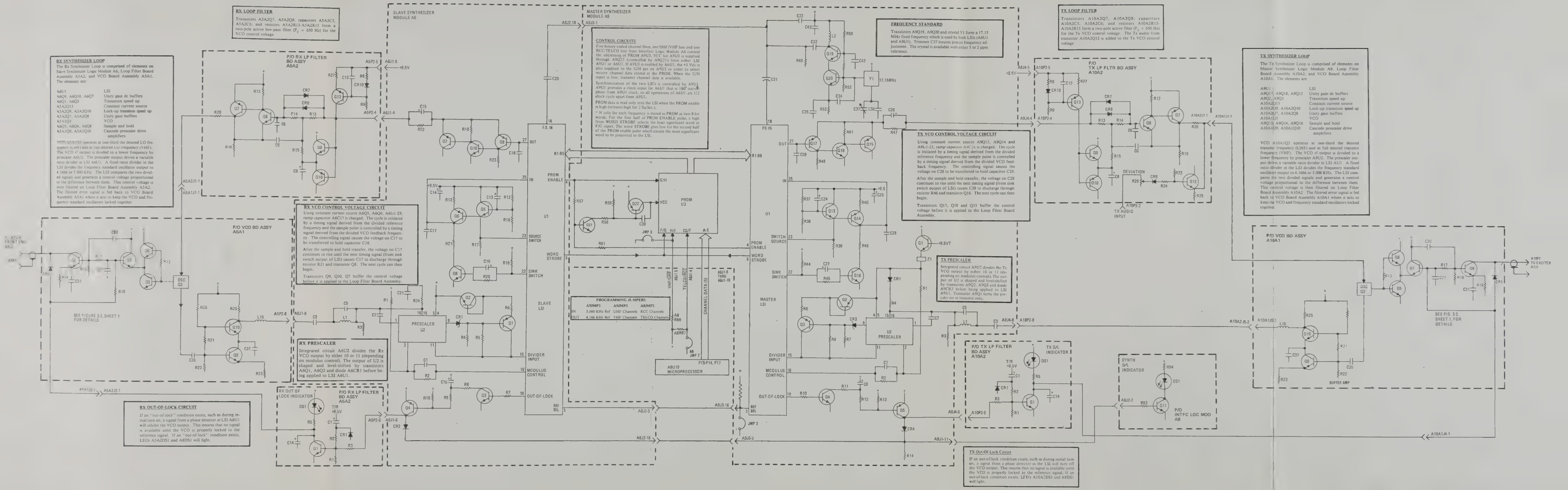
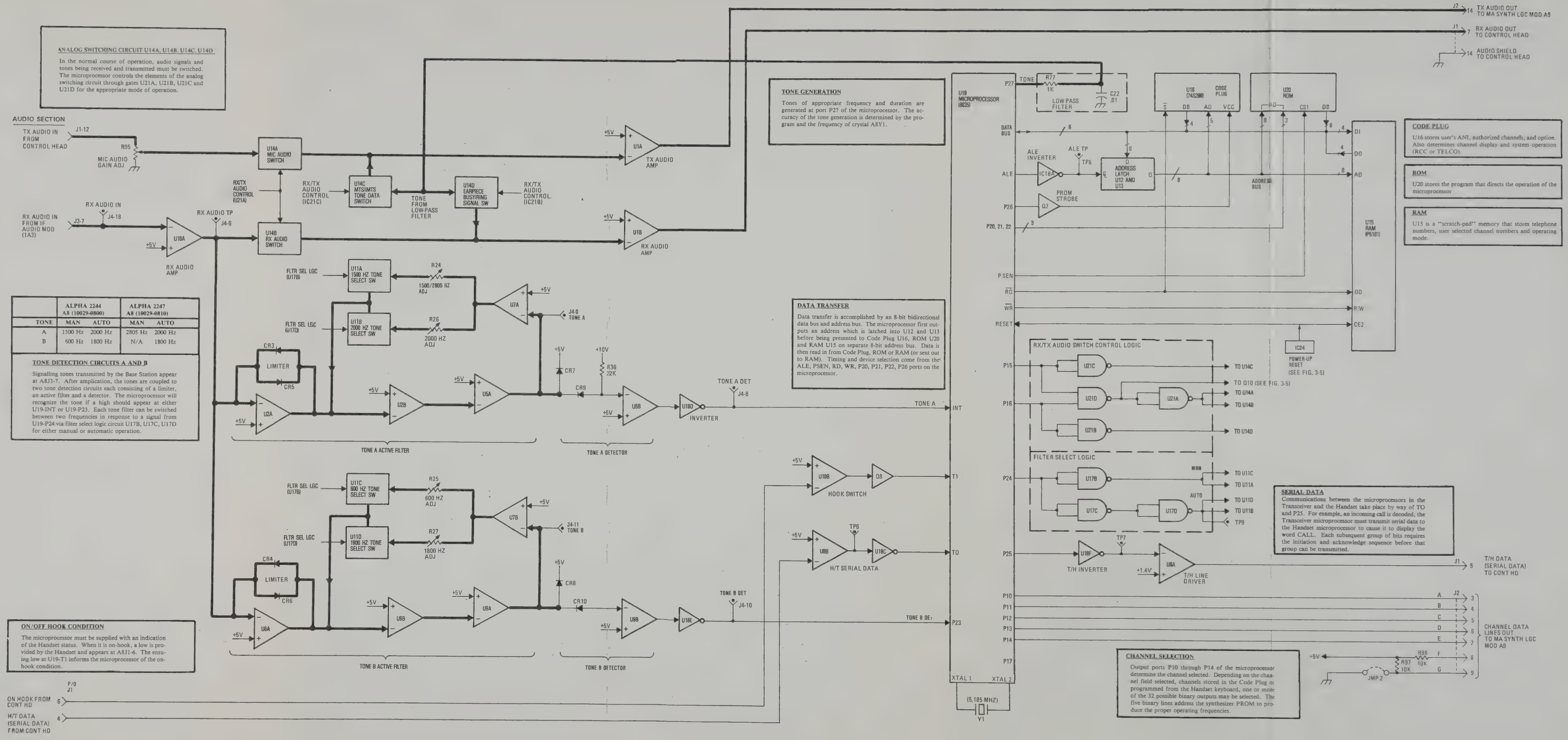


Figure 3-3. Synthesizer, Principles of Operation



ANALOG SWITCHING CIRCUIT U14A, U14B, U14C, U14D

In the normal course of operation, audio signals and tones being received and transmitted must be switched. The microprocessor controls the elements of the analog switching circuit through gates U21A, U21B, U21C and U21D for the appropriate mode of operation.

	ALPHA 2244 A8 (10029-0800)		ALPHA 2247 A8 (10029-0810)	
TONE	MAN	AUTO	MAN	AUTO
A	1500 Hz	2000 Hz	2805 Hz	2000 Hz
B	600 Hz	1800 Hz	N/A	1800 Hz

TONE DETECTION CIRCUITS A AND B

Signalling tones transmitted by the Base Station appear at A8J3-7. After amplication, the tones are coupled to two tone detection circuits each consisting of a limiter, an active filter and a detector. The microprocessor will recognize the tone if a high should appear at either U19-INT or U19-P23. Each tone filter can be switched between two frequencies in response to a signal from U19-P24 via filter select logic circuit U17B, U17C, U17D for either manual or automatic operation.

ON/OFF HOOK CONDITION

The microprocessor must be supplied with an indication of the Handset status. When it is on-hook, a low is provided by the Handset and appears at A8J1-6. The ensuing low at U19-T1 informs the microprocessor of the on-hook condition.

TONE GENERATION

Tones of appropriate frequency and duration are generated at port P27 of the microprocessor. The accuracy of the tone generation is determined by the program and the frequency of crystal A8Y1.

DATA TRANSFER

Data transfer is accomplished by an 8-bit bidirectional data bus and address bus. The microprocessor first outputs an address which is latched into U12 and U13 before being presented to Code Plug U16, ROM U20 and RAM U15 on separate 8-bit address bus. Data is then read in from Code Plug, ROM or RAM (or sent out to RAM). Timing and device selection come from the ALE, PSEN, RD, WR, P20, P21, P22, P26 ports on the microprocessor.

CODE PLUG

U16 stores user's ANI, authorized channels, and option. Also determines channel display and system operation (RCC or TELCO).

ROM

U20 stores the program that directs the operation of the microprocessor

RAM

U15 is a "scratch-pad" memory that stores telephone numbers, user selected channel numbers and operating mode.

SERIAL DATA

Communications between the microprocessors in the Transceiver and the Handset take place by way of TO and P25. For example, an incoming call is decoded, the Transceiver microprocessor must transmit serial data to the Handset microprocessor to cause it to display the word CALL. Each subsequent group of bits requires the initiation and acknowledge sequence before that group can be transmitted.

CHANNEL SELECTION

Output ports P10 through P14 of the microprocessor determine the channel selected. Depending on the channel field selected, channels stored in the Code Plug or programmed from the Handset keyboard, one or more of the 32 possible binary outputs may be selected. The five binary lines address the synthesizer PROM to produce the proper operating frequencies.

Figure 3.4 Interface Logic Module (A8) Principles of Operation

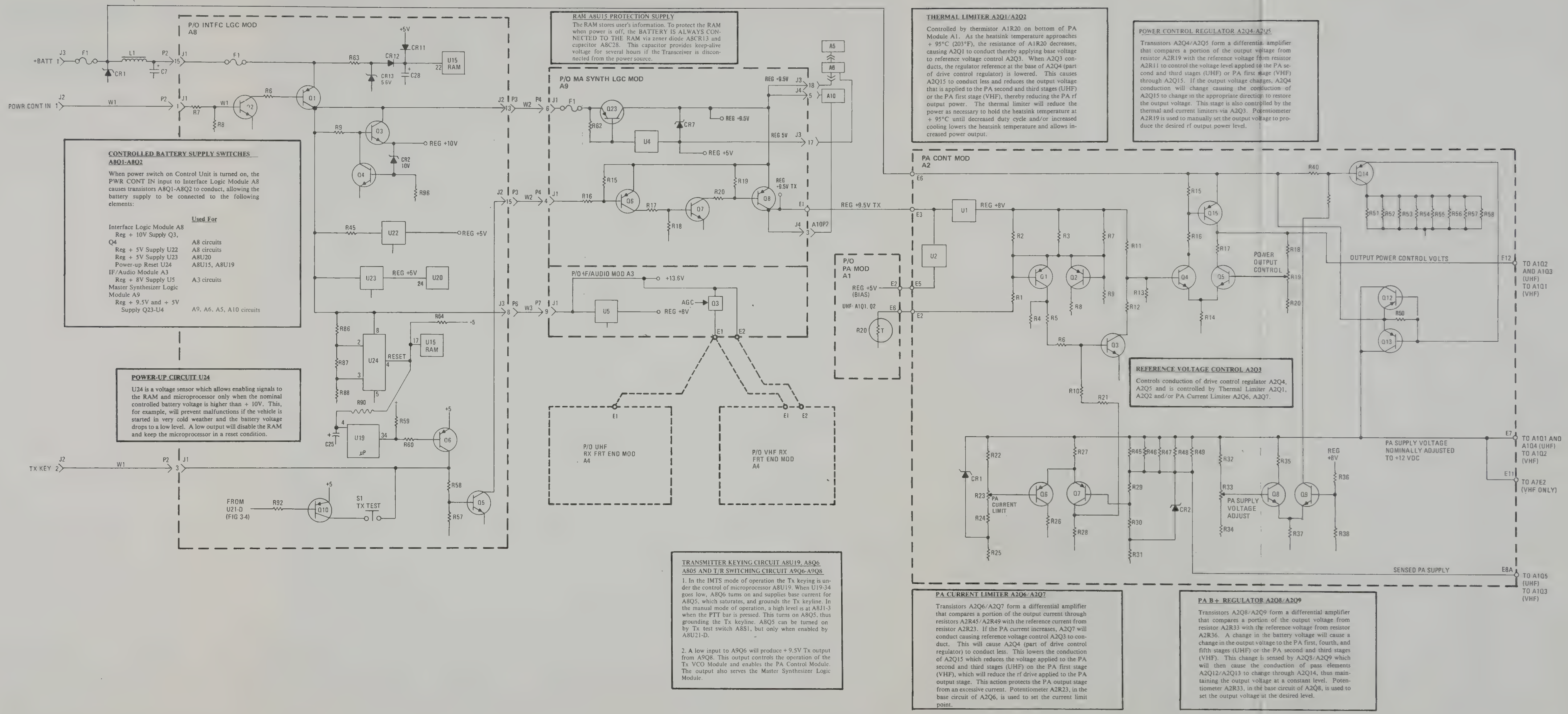


Figure 3-5. Voltage Control, Principles of Operation

Chapter 4
MAINTENANCE

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CHAPTER 4
MAINTENANCE

1. GENERAL

1.01 This chapter contains the procedures to be followed in maintaining the UHF/VHF Transceiver in full operating condition. Routine and preventive maintenance are covered, and a detailed troubleshooting guide is given. Schematic diagrams necessary for detailed examination of the circuitry are provided in the tabbed sections.

2. PREVENTIVE MAINTENANCE

2.01 A complete inspection of the Transceiver and Control Unit should be performed every six months under normal conditions, and more frequently under abnormally severe environmental conditions or usage. Table 4-1 lists items to be inspected and conditions to be observed.

TABLE 4-1

Visual Inspection

Part	Check For
Coiled cord and Transceiver control cable	Abraded, charred or broken insulation. Kinked or broken leads.
Solder connections	Mechanically and electrically secure.
Mounting hardware	Stripped threads, missing items, mechanical deformation.
Cable connectors	Loose, bent or broken contacts.
Resistors	Blistering, charring or cracking.

3. ROUTINE MAINTENANCE

3.01 The inherent life of the components used in the Transceiver and the Control Unit will provide many years of failure-free operation if reasonable care is used. Routine checks should be made to ensure that reliable operation is maintained.

(a) Avoid operation with supply voltages in excess of 16 volts by maintaining a constant check on the condition of the vehicle battery and charging system.

(b) Check that electrical connections are good and that there is no build-up of corrosion, especially at the battery terminals.

(c) At least once a year have the system checked by a licensed technician.

(d) Clean the covers of the Handset, Cradle and Transceiver when necessary. Use a soft cloth moistened with a diluted solution of any household detergent.

4. TROUBLESHOOTING PROCEDURES

A. GENERAL

NOTE

Apparent malfunctions in the Transceiver and the Control Unit may be caused by faults in the vehicle electrical system. Check the battery voltage and regulator under load and ensure that all power connections are secure.

4.01 The troubleshooting procedures detailed in Table 4-2 are not all inclusive. They are intended to highlight the most probable cause of the symptom observed. In those instances where a possible failure in the Transceiver or the Control Unit is indicated, the table directs the technician to that portion of the circuit requiring attention. To isolate the faulty component, the technician should refer to Chapter 3, and the appropriate schematic and assembly diagram in the tabbed sections in this manual. Refer to section 7 in this chapter on the handling of CMOS devices.

TABLE 4-2

Troubleshooting Procedures

Symptom	Probable Cause	Remedy
No sign of operation when Control Unit is turned on.	a) Low battery voltage. b) Ignition switch off. (When +12V line from Cradle is wired to ignition switch.) c) Open fuse in Cradle or Cradle supply line. d) 12V line from Cradle is not connected to vehicle supply.	a) Charge battery. b) Turn on ignition switch. c) Replace fuse. d) Reconnect or replace, if necessary.
C shows in display. Keyboard operates on number keys.	a) Cable disconnected between Cradle and Transceiver.	a) Reconnect cable.
Flashing A1 shows in display.	a) Open fuse in Transceiver. b) Power cable disconnected between battery and the Transceiver or power fuse open.	a) Replace fuse F1 or A8F1. b) Reconnect cable, or replace fuse.
FAIL shows in display. Keyboard operates on number keys.	a) Intermittent cable from Cradle to Transceiver. b) Improper operation of serial data drivers and receivers. c) Crystal in Handset or Transceiver not operating at correct frequency.	a) Check cable connections. b) Check levels and components in Handset-to-Trunk and Trunk-to-Handset drivers in Transceiver. c) Replace if necessary.
FAIL shows dimly in display. Keyboard is inoperative.	a) Trunk-to-Handset or Handset-to-Trunk data line is latched in the high state.	a) Check cable connections and appropriate data driver.
Handset produces continuous tone when function keys are pressed.	a) Microprocessor operating incorrectly. b) Serial data lines defective.	a) Turn power off, then on to reset microprocessors. b) Check connectors and serial data circuits.
Control Unit will not lock on an idle-marked channel. Unit appears continuously BUSY.	a) Wrong mode for system in use. b) Tone A filter not on frequency. (IMTS selected.) c) Tone A detector faulty. (IMTS) d) Tone B filter not on frequency (MAN selected). e) Tone B detector faulty.	a) Select appropriate mode. b) Retune tone A filter. c) Check and repair tone A detector. d) Retune tone B filter to 1500 Hz. e) Check and repair tone B detector.
Control Unit will not decode in IMTS or manual mode.	a) Code plug installed or programmed incorrectly. b) Tone A and/or B filter/detector inoperative.	a) Check code plug. b) Check operation of appropriate filter/detector.
Control Unit will not ANI (Automatic Number Identification) in IMTS mode.	a) All channels are busy. b) Wrong channels are being scanned. c) Audio level to Interface Logic Module (A8) is too low. d) Deviation of Transmitter is incorrect.	a) Wait for a clear channel. b) Select or program appropriate scanning field. c) Set audio signal to correct level. d) Check Transmitter deviation adjustment.

TABLE 4-2

Troubleshooting Procedures (Cont.)

Symptom	Probable Cause	Remedy
Control Unit will handshake. (transmit Guard-Connect-Guard tone sequence) when a call is initiated but does not ANI.	a) Seize tone (tone B) is not detected. b) Receiver de-sensitizing.	a) Check tone B filter/detector. b) Check for proper Transceiver operation.
Control Unit sends ANI, but no dial tone is returned by Base Station.	a) Mobile unit phone number (ANI) is not registered. b) Code Plug is incorrect. c) Distance to Base Station is too great for reliable decoding.	a) Check with telephone company. b) Check code plug. c) Move closer to Base Station.
Dialing is ineffective.	a) System does not accept dialing by a roamer (a mobile subscriber operating outside the home area). b) Incorrect number dialed. c) Distance to Base Station is too great for reliable decoding by Base Station.	a) Check with system operator. b) Check validity of number. c) Move closer to Base Station.

CAUTION: Use a low-wattage grounded soldering iron (25 watts maximum) when replacing components on the printed circuit boards.

4.02 A small high-impedance speaker or earpiece may be connected to Interface Logic Module A8 at test point A8J4-6 to monitor the audio within the Receiver. This is useful when investigating problems associated with scanning, and signaling tones from the base station. Similarly, the transmit audio can be monitored at A8C19 to check ANI, dialing operations, and connect-disconnect tones, or by entering the special test mode (see section G).

B. Modules and Board Assemblies

4.03 Figures 4-3 and 4-6 identify and locate the Modules and Board Assemblies in the UHF and VHF Transceivers.

C. Internal Controls and Indicators

4.04 Figures 4-4 and 4-7 identify and locate the Internal Controls and Indicators in the UHF and VHF Transceivers.

D. Test Points

4.05 Figures 4-5 and 4-8 identify and locate the Test Points in the UHF and VHF Transceivers.

E. Tracing Printed Circuits

4.06 Special composite illustrations of printed circuit boards are provided within the tabbed sections in this manual. These show the component side with the wiring side shown in phantom.

F. Audio Paths

4.07 Figure 4-1 shows the simplified transmit and receive audio path circuits.

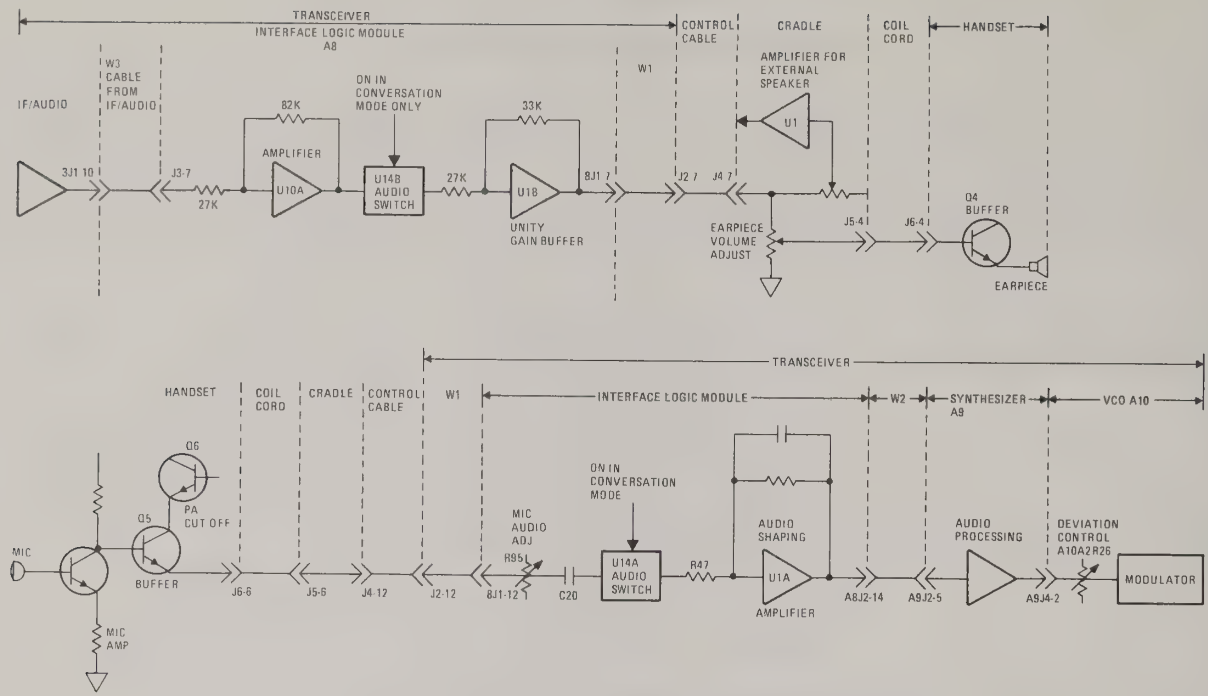


Figure 4-1. Simplified Transmit and Receive Audio Path Diagrams

G. Special Test Mode

4.08 A special test mode is incorporated in the microprocessor program of the Interface Logic Board. This test mode bypasses the access mode (electronic lock) and allows the generation and monitoring of ten test tones. It also allows the monitoring of all outgoing signaling tones. Repertory dialing (recall of stored numbers) is not available during the test mode, but the Control Unit operates normally otherwise. RCL pushbutton, followed by a number pushbutton generates one of the ten test tones and sends it to the Transmit Audio circuit and handset earpiece (microphone and receive audio circuits are disabled during this operation). The selected tone will be generated for about one minute (less for higher frequency tones). Hang up handset to reset audio paths and/or stop tone generation. During tone generation, no Control Unit keyboard functions can be processed, but they will be as soon as the tone is completed.

TABLE 4-3. Special Test Mode Procedure

Step	Procedure
1.	Set cradle ON/AUX/OFF switch in OFF position.
2.	Enter Test Mode by simultaneously pressing 8 pushbutton and PTT bar while setting Cradle ON/AUX/OFF switch in ON position. Number 8 should appear on display. If not, repeat steps 1 and 2.
3.	Select desired operating mode. Ignore access in display. **NOTE** *When the test tone is being generated, no keyboard functions can be processed. Also, the test tone can be terminated at any time by going on hook.*

4.09 The available test tones are listed below.

RCL	0	802 Hz
	1	2810 Hz
	2	1631 Hz
	3	1335 Hz
	4	1490 Hz
	5	2147 Hz
	6	1998 Hz
	7	1002 Hz
	8	600 Hz
	9	1809 Hz

H. Transmit Test

4.10 A Transmit Test circuit is located on Interface Logic Module A8. When in the conversational mode, Tx Test switch A8S1 can be used as a local PTT switch.

5. ALIGNMENT

5.01 The Receiver, Transmitter and Duplexer alignment procedures are presented in figures 4-9, 4-11, and in Table 4-4. Receiver Performance Test is presented in figure 4-10. Duplexer Insertion Loss measurement is presented in figure 4-12.

6. PA MODULE A1 COMPONENT REPLACEMENT

6.01 The following precautionary information should be strictly adhered to when replacing components on PA Module A1 since component lead length and positioning may affect operational reliability and efficiency. Refer to PA Tab Section Maintenance for detail.

6.02 Resistors, Chokes and Diodes

(a) Make sure that the lead length of the replacement component is the same as the original component.

(b) Make sure that component leads inserted into the board are fully seated in their respective holes.

(c) Make sure that the choke lead connected to variable capacitor C32 protrudes no more than 1/32-inch through the capacitor tab (VHF only).

6.03 Capacitors

(a) When replacing the silvered mica capacitors, refer to the lead forming information contained in PA Tab Section Maintenance.

(b) When reinstalling capacitors on the board, make sure they are precisely positioned over the printed circuit lands.

6.04 Transistors

(a) Refer to PA Tab Section Maintenance for details.

(b) When replacing power transistors, use the old transistor as a guide to trim the transistor leads.

(c) Pre-tin the underside of the transistor leads and its mating surface on the board.

(d) Make sure that there are no lumps or an excessive build-up of solder on the transistor leads or their mating surface on the board.

(e) Apply a thin coating of thermal grease to the underside of the transistor body before installing it.

(f) Make sure that the transistor leads are properly positioned on their respective traces before soldering or tightening the mounting hardware.

6.05 Before replacing Thermistor A1R20 (UHF) or A1R11 (VHF) make sure that an adequate amount of thermal grease has been placed in the well. (See figure 4-2.)

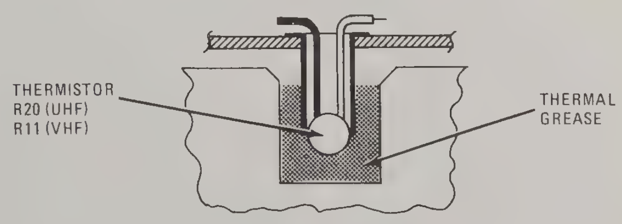


Figure 4-2. Placement of Thermistor

7. HANDLING OF CMOS DEVICES

A. Reason for Special Handling

7.01 CMOS integrated circuit devices have very high gate input impedance and are susceptible to damage from electrostatic discharge. Static voltages generated by normal actions can be as high as 5 to 15 KV, and can destroy CMOS gates with no outward indication. To guard against damage, most CMOS manufacturers build in protective networks which consist mainly of diodes and resistors acting as voltage limiters. These networks, while generally effective, will not protect against fast-rise-time, high-level static discharges.

7.02 Equipment and procedures outlined below have been developed to reduce or eliminate the possibility of physical damage occurring to CMOS devices by neutralizing or eliminating the build-up of harmful static voltages. These procedures are strongly recommended for use in service shops, etc., to prevent damage to CMOS devices during repair/replacement activities.

B. Work Bench Equipment Setup

7.03 The equipment listed should be installed and operating where CMOS devices are handled outside a protective container. These precautions should be considered by those who routinely handle CMOS devices.

(a) An antistatic work surface mat should cover the surface to be used for CMOS handling and must be connected to an individual earth ground. Suitable mats can be cut from 3M ''Velastat'' or Simco ''Neutro-Stat.''

(b) Those who contact unmounted CMOS leads or packages should wear a conductive wrist strap (bonded to a conductive work mat and earth ground) while handling the CMOS devices. Exercise care when handling electronic equipment while wearing wrist straps, to minimize potential shock hazard. As a precaution, connect the wrist strap to the mat through a one megohm resistor to prevent injury.

(c) Ideally, an ionized air blower should be installed at each work bench to neutralize static electricity. Simco models AS-10, AS-20, or APS Portable or equivalent may be used. The blower should be positioned five feet from the work surface mat, and the air directed at the front of the mat and surrounding area to obtain proper coverage.

C. Storage and Transport

7.04 CMOS Devices are normally shipped to users in antistatic tubes or conductive containers supplied by the manufacturer. If you receive any devices which you believe have been shipped in unsuitable containers, simply return them to the source and explain why they are being returned. Request replacements which are suitably packed.

7.05 Appropriate containers normally supplied by manufacturers include:

(a) Metal tubes.

(b) Black, carbon-impregnated plastic tubes.

(c) Pink-colored plastic tubes with a sticker stating that it is an antistatic tube. (Do not reuse this container.)

(d) Black, carbon-impregnated foam. (Will show resistance of less than 500K ohms per inch.)

CAUTION

Do not use styrofoam blocks, clear plastic bags or bins for storing or transporting CMOS Integrated Circuits.

D. Screening and Inspection

7.06 All CMOS devices purchased by Harris/RF Communications for use in production or spare parts are ''burned-in'' and screened by an approved independent laboratory prior to use. Plastic devices undergo the following tests:

(b) Reverse bias burn-in 125 °C, 168 hours.

(c) 100 percent dc parameters/functional testing at 25 °C.

7.07 Thermal shock is deleted as a requirement for ceramic IC's. Upon completion of the testing, all acceptable IC's are marked with a colored dot. This testing helps to maximize the reliability of all RF products, including spare parts.

E. Basic Rules

7.08 It may not be feasible to follow all the preceding recommendations; however, the basic rules listed below should be followed:

(a) Keep CMOS IC's in their protective conductive packaging until ready for use.

(b) Do not connect IC's, or cards containing U's, in or out of circuit with power applied.

(c) Use a grounded tip soldering iron at all times.

(d) When removing IC's from protective packaging, hold the package with one hand and remove the device with the other hand, while holding the IC by the ends and not touching any of the metal leads.

(e) When inserting a CMOS device into a board or socket, hold the PC board with one hand and insert the device while still holding the board.

7.09 When making contact between a CMOS IC and any material, use your body to equalize the potential between them. Never allow the IC to act as an intermediary between two potentially charged materials. Always pick up or contact the IC at the ends of the package.

8. INTEGRATED CIRCUITS AND TRANSISTORS

8.01 Pin locations and lead identifications for the integrated circuits and transistors are shown in figures 4-14 and 4-15 at the end of this chapter.

Figure 4-3. UHF Transceiver, Modules and Board Assemblies

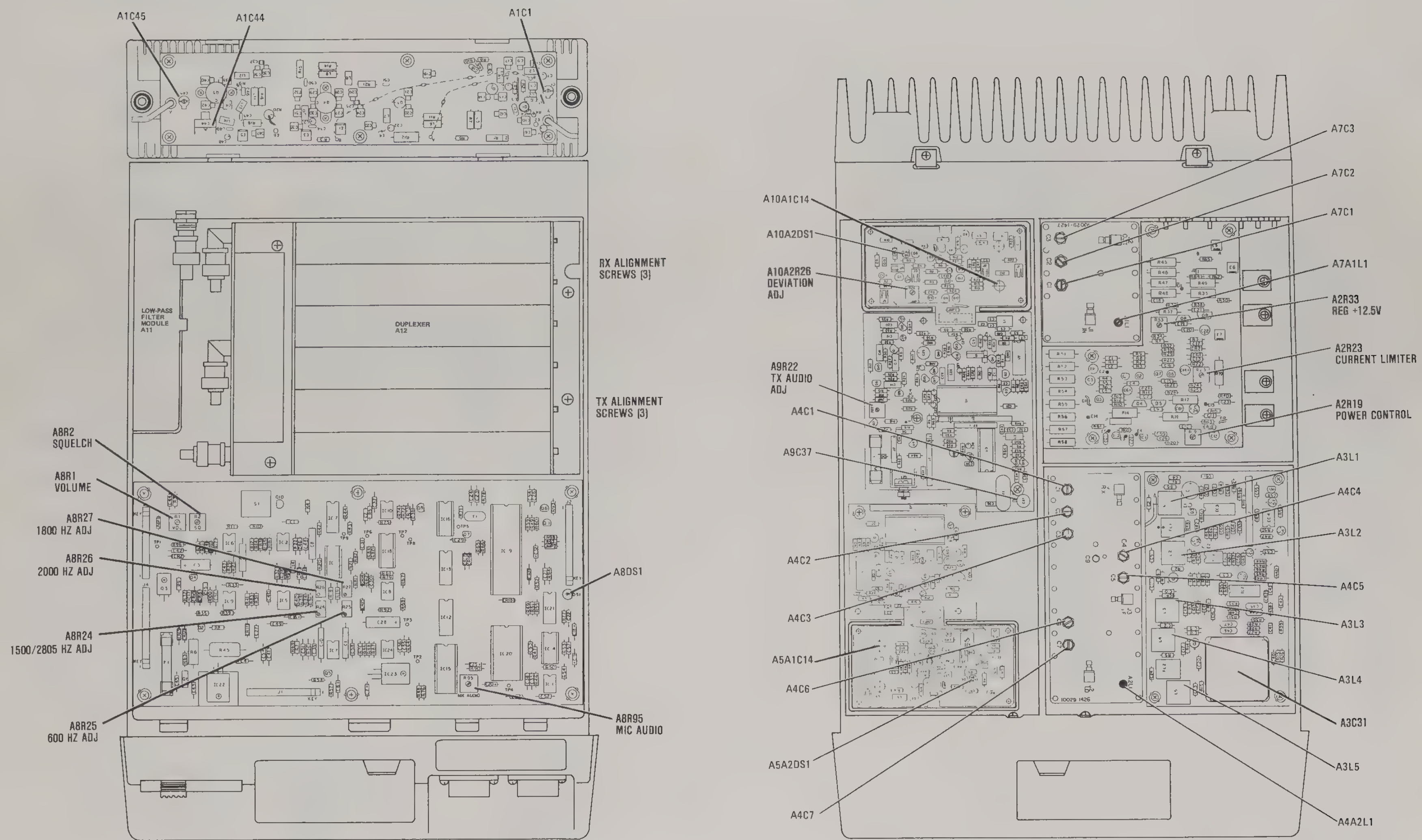


Figure 4-4. UHF Transceiver, Internal Controls and Indicators

Figure 4-5. UHF Transceiver, Test Points

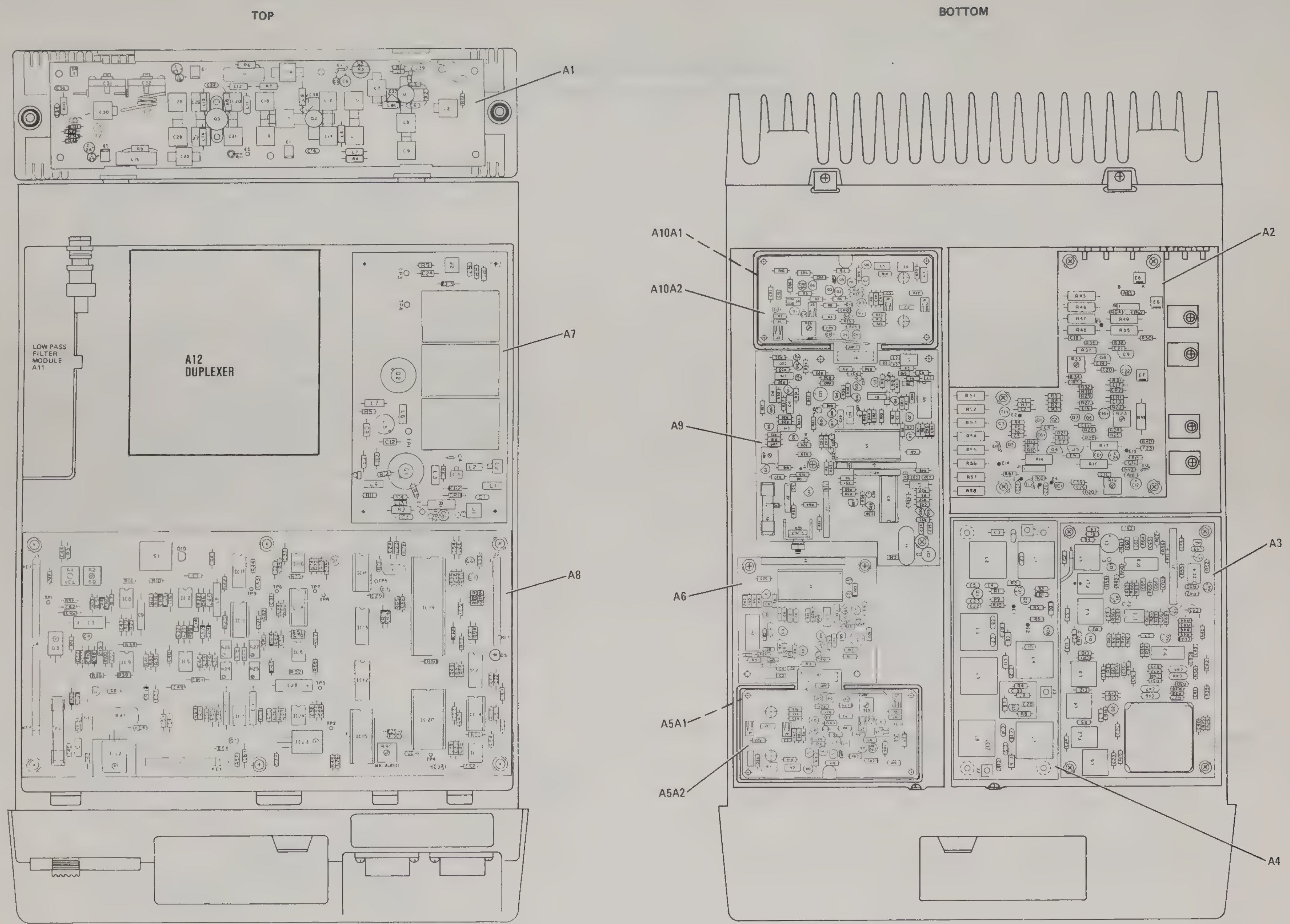


Figure 4-6. VHF Transceiver, Modules and Board Assemblies

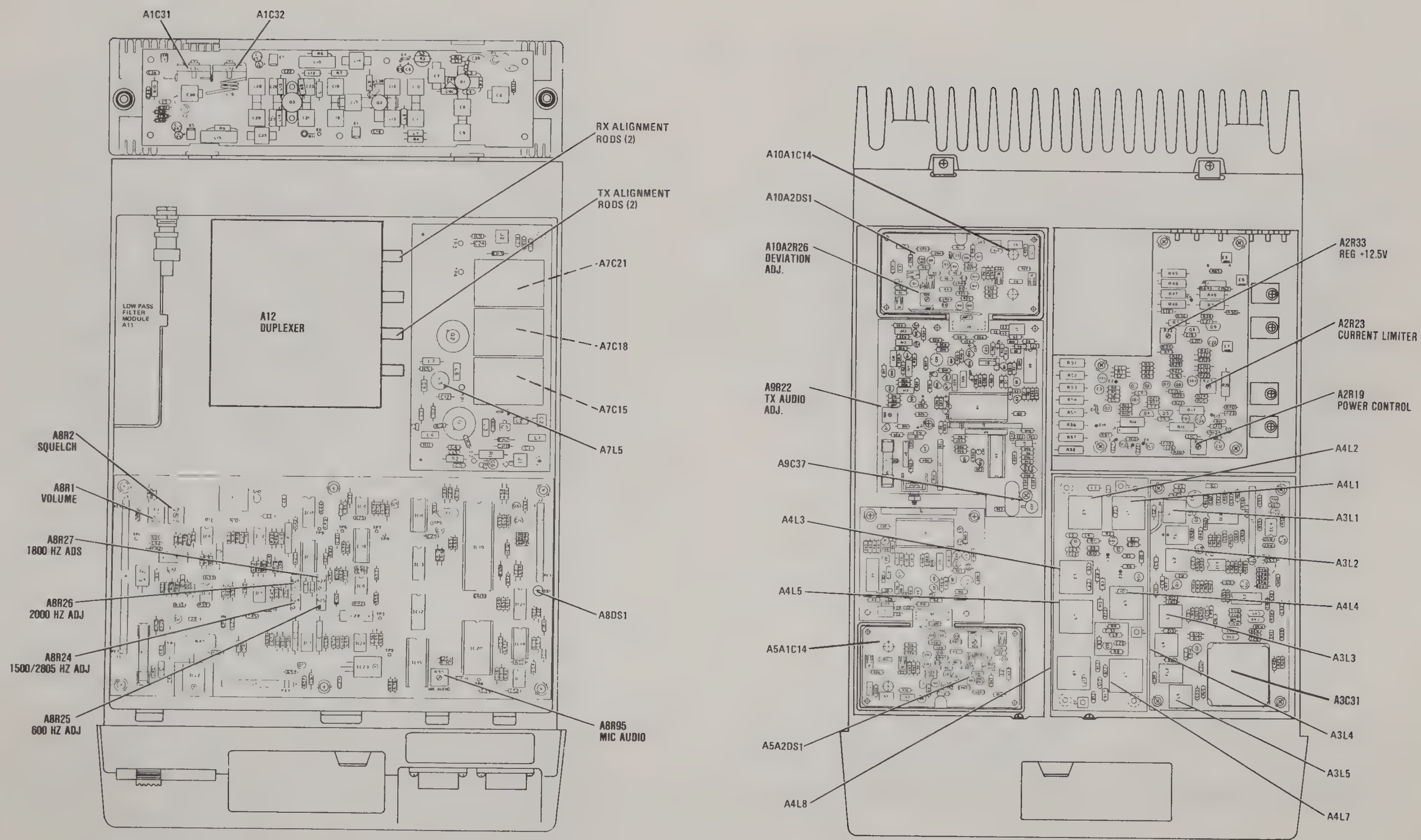


Figure 4-7. VHF Transceiver, Internal Controls and Indicators

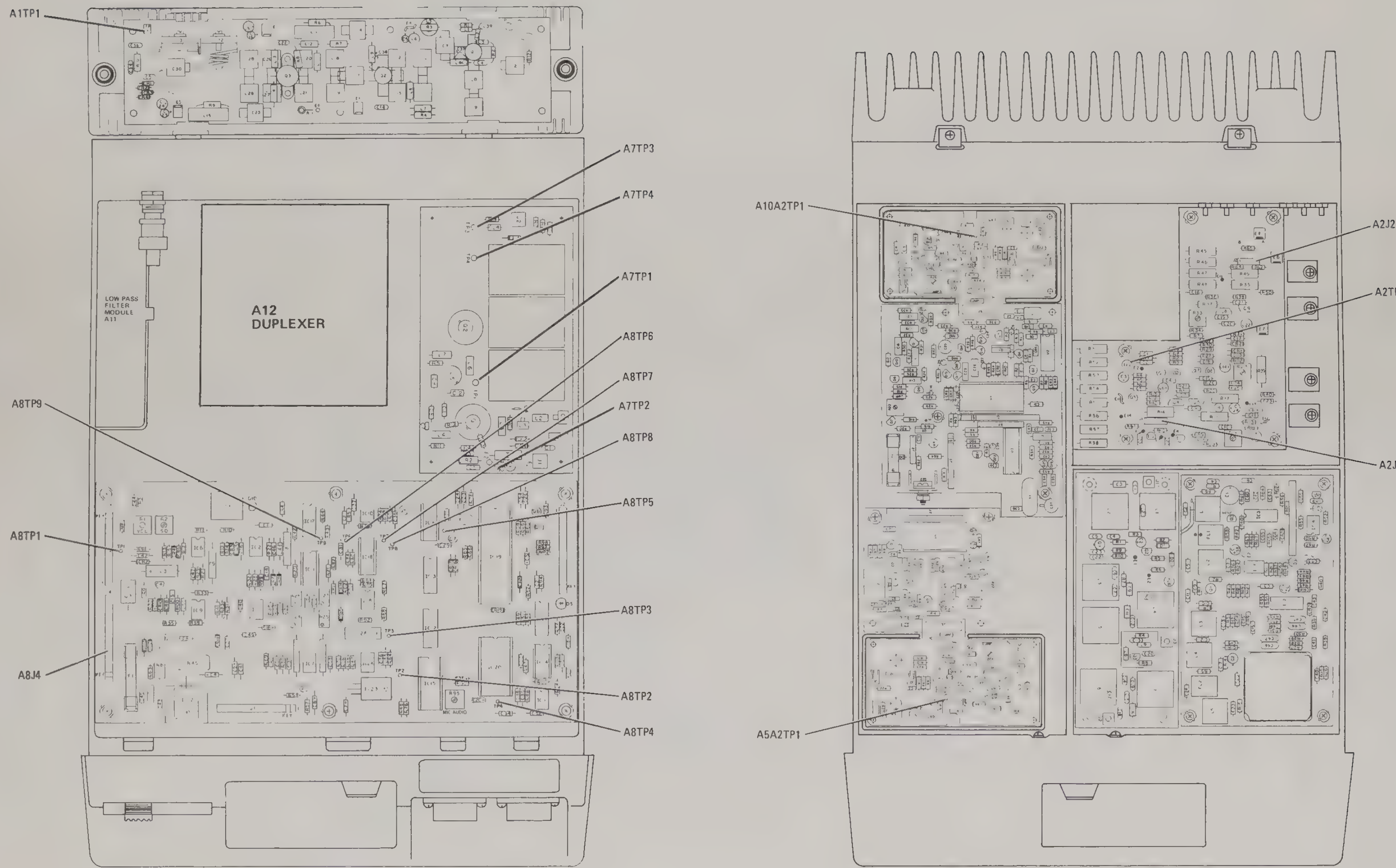


Figure 4-8. VHF Transceiver, Test Points

Unless otherwise indica
both the UHF and VH

1. At Control Unit sel
channel.

Voltage measurements
otherwise indicated.

Ensure that + 13.6 vo

DERIVING VCO OPERATING FREQUENCIES

: 406-450 MHz

$$VCO = \frac{\text{Rx Frequency} + 21.4\ \text{MHz}}{3}$$

450-512 MHz

$$VCO = \frac{\text{Rx Frequency} - 21.4\ \text{MHz}}{3}$$

: 132-150.8 MHz

VCO = Rx Frequency + 21.4 MHz

150.8-174 MHz

VCO = Rx Frequency − 21.4 MHz

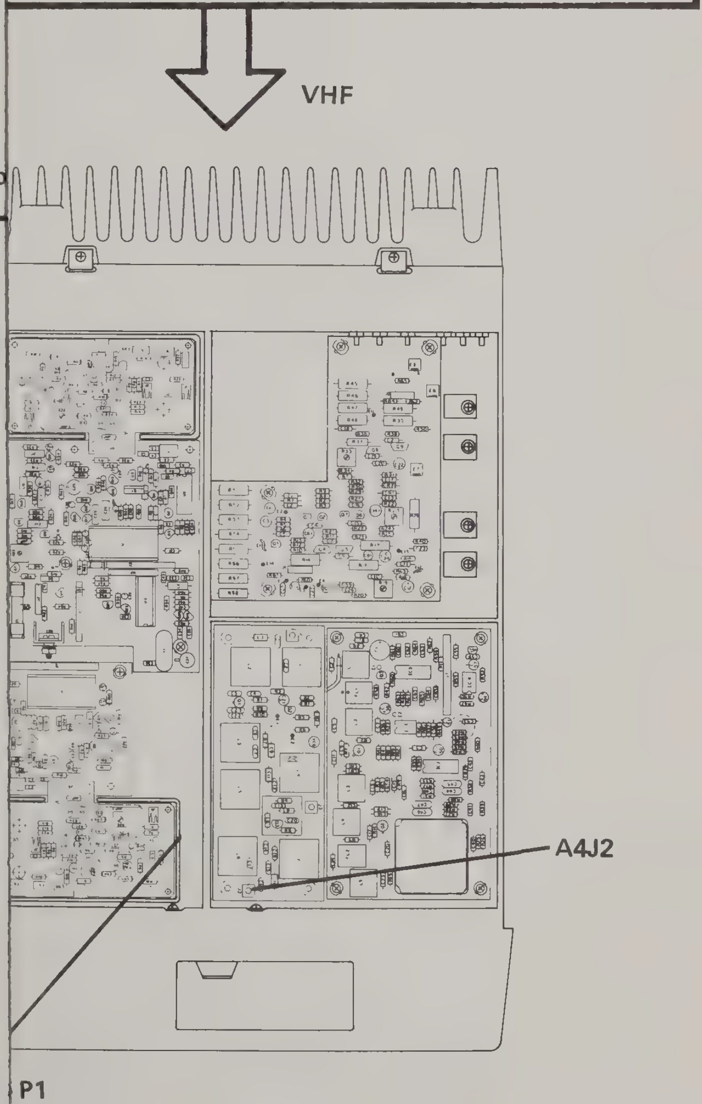


Figure 4-9. Receiver Alignment Procedure (Sheet 1 of 3)

NOTE

Unless otherwise indicated, the following steps apply to both the UHF and VHF Transceivers.

1. At Control Unit select manual operation and center channel.

NOTE

Voltage measurements are with respect to ground unless otherwise indicated.

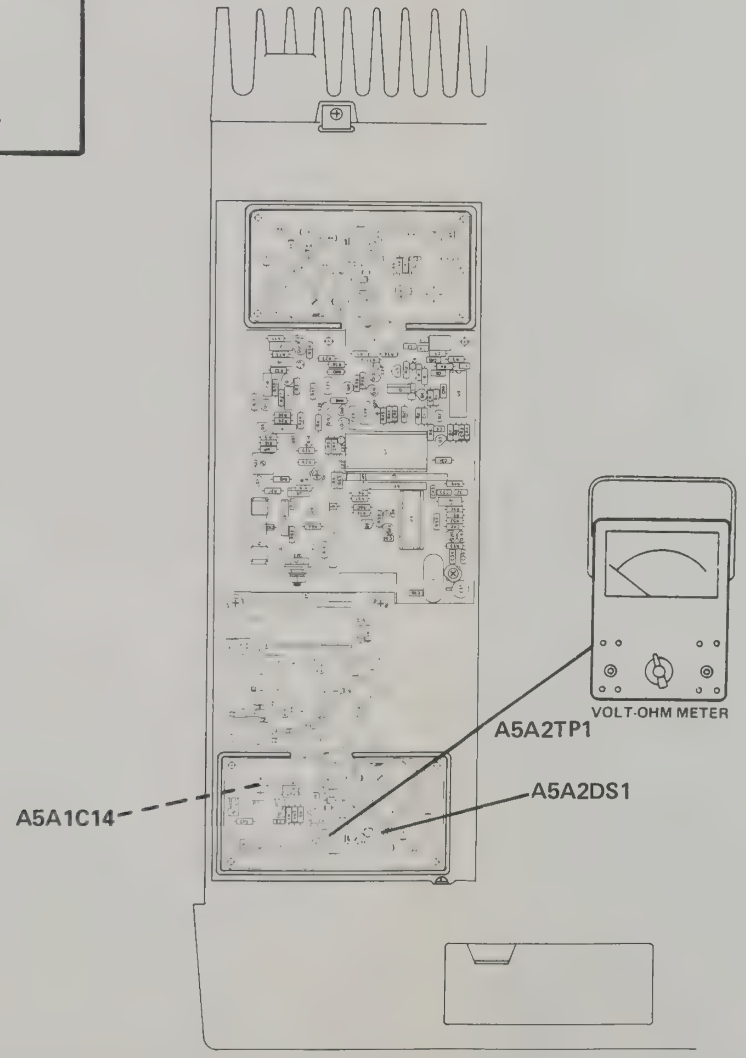
NOTE

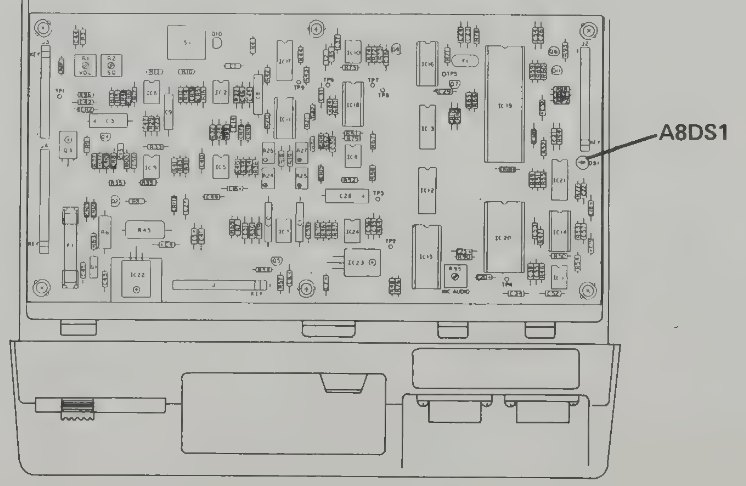
Ensure that + 13.6 volts dc is present at A8J4-4.

2. Connect DC voltmeter between test point A5A2TP1 and ground.

3. Adjust trimmer A5A1C14 (accessible through hole in A5A2 board assembly) until indicator A5A2DS1 dims and indicator A8DS1 goes out.

4. Continue to adjust A5A1C14 until a + 5.6 volt dc indication is obtained at A5A2TP1. Indicator A5A2DS1 must remain dim and indicator A8DS1 must remain off. Disconnect DC voltmeter.





5. Disconnect A5P1 from A4J2. Connect A5P1 through a blocking capacitor to frequency counter.

6. Observe frequency indication. Correct frequency can be derived as shown at right.

DERIVING VCO OPERATING FREQUENCIES

UHF: 406-450 MHz

$$VCO = \frac{\text{Rx Frequency} + 21.4\ \text{MHz}}{3}$$

450-512 MHz

$$VCO = \frac{\text{Rx Frequency} - 21.4\ \text{MHz}}{3}$$

VHF: 132-150.8 MHz

VCO = Rx Frequency + 21.4 MHz

150.8-174 MHz

VCO = Rx Frequency − 21.4 MHz

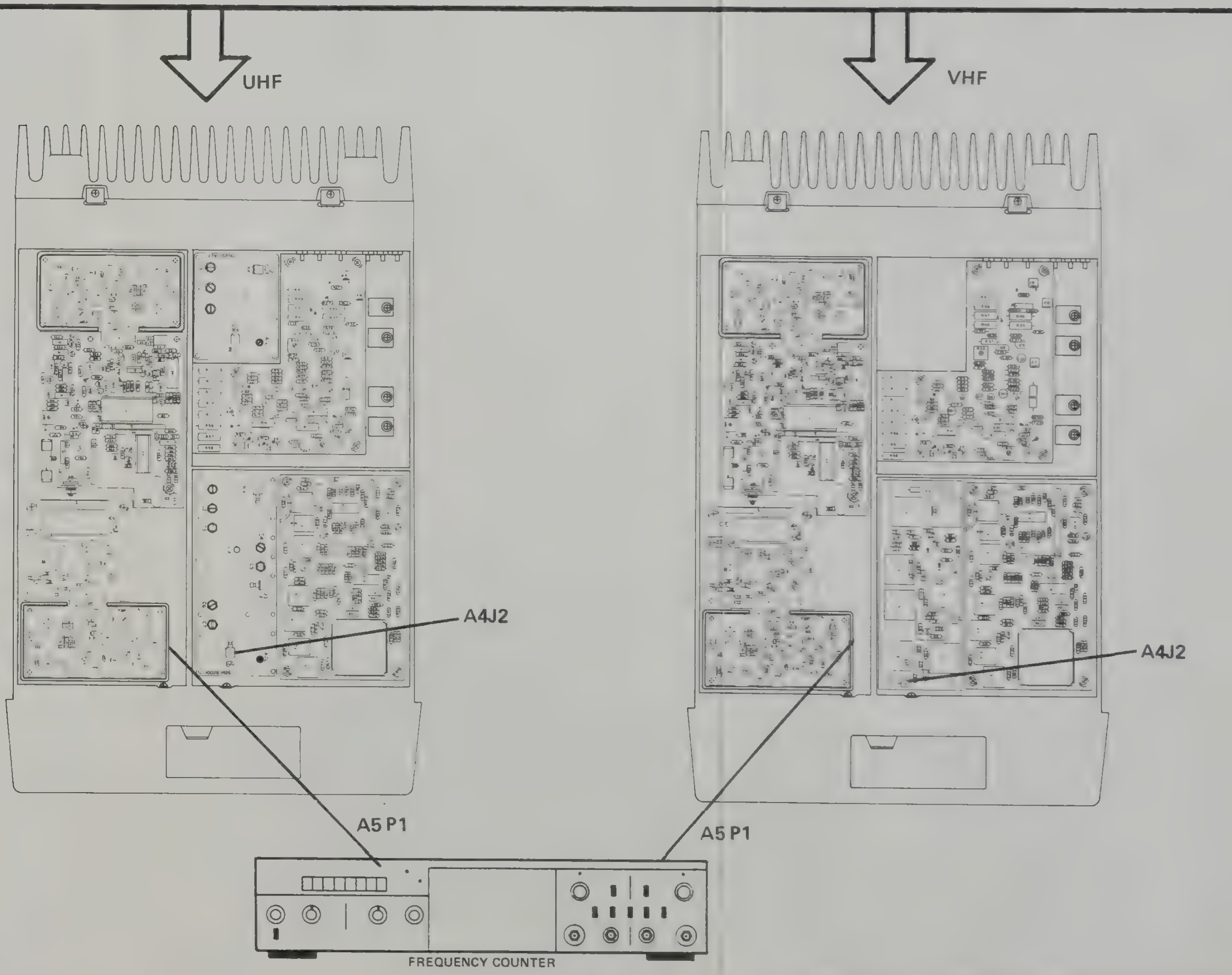


Figure 4-9. Receiver Alignment Procedure (Sheet 1 of 3)

7. Connect DC voltmeter between CONT BATT test point A8J4-4 (+) and MIXER test point A8J4-15 (−).

NOTE

These test points are elevated above ground potential by approximately 14 volts; therefore the DC voltmeter must be floating.

8. **UHF:**

   Adjust inductor A4A2L1 and trimmers A4C6 and A4C7 for maximum indication. This indication will be approximately 0.15 to 0.25 Vdc.

   VHF:

   Adjust inductors A4L7 and A4L8 for maximum indication. This indication will be approximately 0.15 to 0.25 Vdc

9. Disconnect TX keyline at A2E3 to disable Transmitter.

10. Connect FM signal generator to antenna connector J1. Set generator to center channel frequency with modulation at 1000 Hz with ± 5 KHz deviation.

11. Connect DC voltmeter between signal strength test point A8J4-16 (+) and ground test point A8J4-1 (−)

12. Adjust FM signal generator output level until 4.0 to 4.2 Vdc indication is obtained on DC voltmeter.

13. **UHF:**

    Adjust trimmers A4C1 thru A4C5 for maximum indication on DC voltmeter. **DO NOT ADJUST** A4C6, A4C7 and A4A2L1. If necessary, readjust FM signal generator output level to maintain 4.0 to 4.2 Vdc indication.

    VHF:

    Adjust inductors A4L1 thru A4L5 for maximum indication on DC voltmeter. **DO NOT ADJUST** A4L7 and A4L8.

14. Using a <u>NON-METALLIC</u> tuning tool, adjust A3L1 through A3L5 for maximum indication on DC voltmeter. If necessary, readjust FM signal generator output level

15. Connect DC voltmeter between DISC (+) test point A8J4-17 (+) and DISC (−) test point A8J4-14 (−).

NOTE

These test points are elevated above ground potential by approximately 5 volts; therefore the DC voltmeter must be floating.

16. Reduce FM signal generator deviation to ± 3 KHz.

17. Adjust trimmer A3A1C31 (accessible through hole in large shield can) until zero indication is obtained on DC voltmeter. Disconnect DC voltmeter.

18. Connect AC voltmeter (blocked for dc) between RX AUDIO test point A8J4-6 and GROUND test point A8J4-1. Adjust volume control A8R1 until an indication of 1.0 VRMS is obtained. Disconnect AC voltmeter.

19. Connect SINAD meter between RX AUDIO test point A8J4-6 and GROUND test point A8J4-1.

20. Adjust FM signal generator output level until 12 dB SINAD indication is obtained.

NOTE

Under **NO** circumstances should any IF/Audio Module A3 adjustments be changed during the following fine SINAD adjustment steps.

21. **UHF:**

    Fine adjust trimmers A4C1 thru A4C5 for maximum SINAD indication. **DO NOT ADJUST** A4C6, A4C7 and A4A2L1.

    VHF:

    Fine adjust inductors A4L1 through A4L5 for maximum SINAD indication. **DO NOT ADJUST** A4L7 and A4L8.

22. Remove test equipment.

23. Reconnect TX keyline to A2E3.

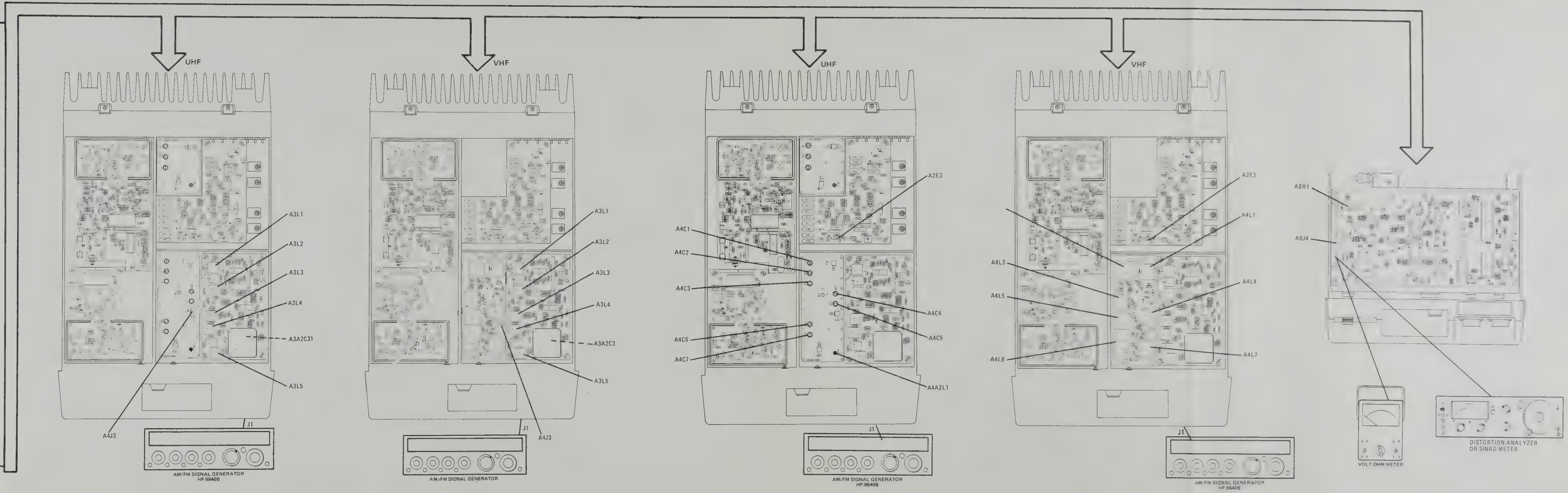


Figure 4-9. Receiver Alignment Procedure
(Sheet 2 of 3)

TONE FILTER ADJUSTMENT

(a) Disable Receiver by disconnecting P6 from A8J3.

(b) Connect audio generator to test point A8J4-18.

(c) Connect one channel of oscilloscope to RX AUDIO test point A8J4-6 (use for trigger source) and the other channel to TONE A test point A8J4-9.

(d) Connect frequency counter to RX AUDIO test point A8J4-6.

FOR ALPHA 2244 AND 2247 MODELS

(e) Set unit in Automatic mode of operation (AUT) as evidenced by AA1, AA2, or AH on display.

(f) Set audio generator for 2000 ± 1 Hz and adjust level to 0.15 volts RMS.

(g) Adjust A8R26 for a 180° phase shift at TONE A test point A8J4-9. Signal should be at peak amplitude.

(h) Move oscilloscope probe from TONE A test point A8J4-9 to TONE B test point A8J4-11.

(i) Set audio generator for 1800 ±1 Hz and adjust level to 0.15 volts RMS.

(j) Adjust A8R27 for a 180° phase shift at TONE B test point A8J4-11. Signal should be at peak amplitude.

FOR ALPHA 2244 MODELS (IMTS/MTS):

(k) Set unit in Manual Mode of operation (MAN) as evidenced by A1A2, or H in display.

(l) Set audio generator for 600 ±1 Hz and adjust level to 0.15 volts RMS.

(m) Adjust A8R25 for a 180° phase shift at TONE B test point at A8J4-11. Signal should be at peak amplitude.

(n) Set audio generator for 1500 ±1 Hz and adjust level to 0.15 volts RMS.

(o) Adjust A8R24 for a 180° phase shift at TONE A test point A8J4-9. Signal should be at peak amplitude.

(p) Disconnect test equipment and reconnect P6 to A8J3.

OR

FOR ALPHA 2247 MODELS (IMTS/2805)

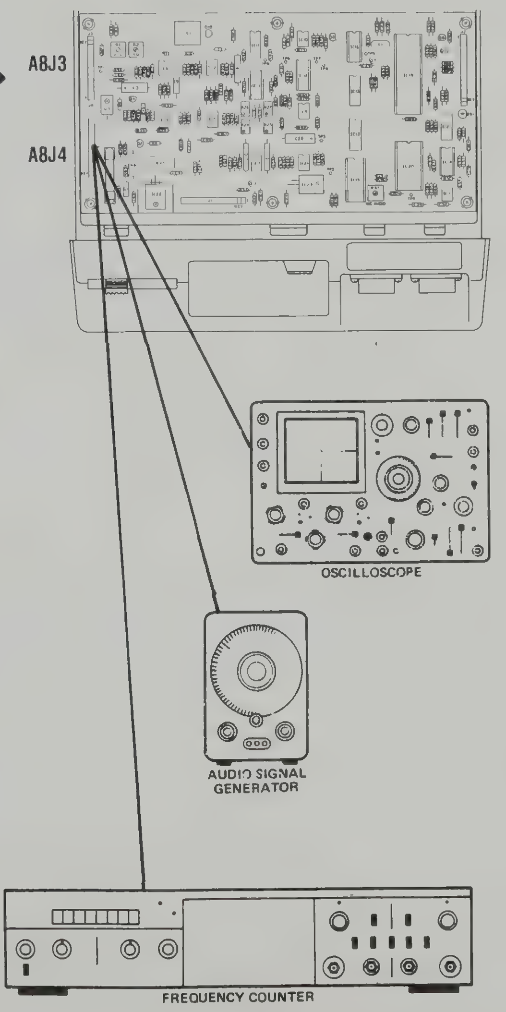
(k) Set unit in Manual Mode of operation (MAN) as evidenced by A1A2, or H in display.

(l) Set audio generator for 2805 ±1 Hz and adjust level to 0.15 volts RMS.

(m) Adjust A8R24 for a 180° phase shift at TONE A test point A8J4-9. Signal should be at peak amplitude.

NOTE – A8R25 NOT USED.

(n) Disconnect test equipment and reconnect P6 to A8J3.



ALTERNATE TONE FILTER ADJUSTMENT

NOTE 1: Although not as accurate, tone filters may be aligned using internally generated tones, if an accurate signal generator/counter is not available.

NOTE 2: In the following procedure when test tones are being generated, no keyboard commands can be processed. The test tones will stop automatically after approximately one minute or when the handset goes on hook.

(a) Disable Receiver by disconnecting P6 from A8J3.

(b) Connect one channel of oscilloscope to RX AUDIO test point A8J4-6 (use for trigger source) and the other channel to TONE A test point A8J4-9.

(c) Connect jumper between REC AUDIO IN test point A8J4-18 and either end of jumper A8JMP3 (near A8J2).

FOR ALPHA 2244 AND 2247 MODELS

(d) On Alpha 40 Control Unit enter test mode and select automatic mode.

See Section G in this chapter for test mode operation.

(e) Generate 2000 Hz tone by pressing [RCL] and [6] pushbuttons.

(f) Adjust A8R26 for a 180° phase shift at TONE A test point A8J4-9, Signal should be at peak amplitude.

(g) Generate 1800 Hz tone by pressing [RCL] and [9] pushbuttons.

(h) Adjust A8R27 for a 180° phase shift at TONE B test point A8J4-11. Signal should be at peak amplitude.

(i) Select manual mode.

FOR ALPHA 2244 MODELS (IMTS/MTS):

(j) Generate 600 Hz tone by pressing [RCL] and [8] pushbuttons.

(k) Adjust A8R25 for a 180° phase shift at TONE B test point A8J4-11. Signal should be at peak amplitude.

(l) Generate 1500 Hz tone by pressing [RCL] and [4] pushbuttons.

(m) Adjust A8R24 for a 180° phase shift at TONE A test point A8J4-9. Signal should be at peak amplitude.

(n) Remove jumper, disconnect oscilloscope and reconnect P6 to A8J3.

FOR ALPHA 2247 MODELS (IMTS/2805)

(j) Generate 2805 Hz tone by pressing [RCL] and [1] pushbuttons.

(k) Adjust A8R24 for a 180° phase shift at TONE A test point A8J4-9. Signal should be at peak amplitude.

NOTE – A8R25 NOT USED.

(l) Remove jumper, disconnect oscilloscope and reconnect P6 to A8J3.

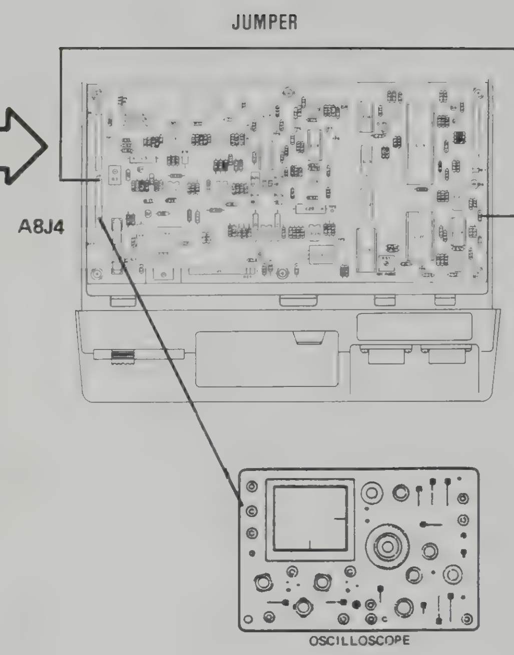


Figure 4-9. Receiver Alignment Procedure (Sheet 3 of 3)

RECEIVER PERFORMANCE TESTS

Receiver Sensitivity

In a full duplex Transceiver, the only true measure of Receiver operation is with the Transmitter on and a combination measurement of Receiver sensitivity and Transmitter desensitization is being made.

The 12 dB SINAD method of measuring Receiver sensitivity is the preferred procedure. If a distortion Analyzer or SINAD meter is not available, use the 20 dB quieting method.

12 dB SINAD METHOD

(a) Connect signal generator through calibrated* power attenuator and wattmeter to Transceiver antenna connector.

(b) Connect distortion analyzer or SINAD meter between RX AUDIO test point A8J4-6 and GROUND test point A8J4-1.

(c) Set signal generator controls for channel frequency with 1000 μV output and 1 KHz modulation. Set deviation at $\pm$3.3 KHz.

(d) Tune distortion analyzer for minimum indication or null on lowest possible scale.

(e) Set distortion analyzer selector switch at Set Level position and adjust input level control to obtain full-scale indication.

(f) Reduce signal generator output level until indication is 12 dB down (distortion position) from full-scale indication (set level position) or until SINAD meter indicates 12 dB. Observe signal generator output level and subtract calibrated* power attenuator to determine Receiver 12 dB sensitivity.

(g) Key Transmitter and check for proper power output. Readjust signal generator output level to obtain 12 dB indication. Record signal generator output level less attenuation factor. The Receiver 12 dB sensitivity should be 0.35 μV or less with Transmitter on.

20 dB Quieting Method

(a) Connect test equipment as required in the 12 dB SINAD method. However, connect AC voltmeter (ac coupled) to RX AUDIO test point A8J4-6 in place of SINAD meter.

(b) With no rf signal input to Transceiver, observe AC voltmeter indication.

(c) Set signal generator controls for 100μV CW output at channel frequency. Reduce signal generator output level until indication on AC voltmeter is 20 dB below the level noted in step (b). Fine tune frequency and readjust output level to obtain 20 dB indication.

(d) Observe signal generator output level and subtract calibrated* power attenuator attenuation to determine Receiver 20 dB quieting sensitivity.

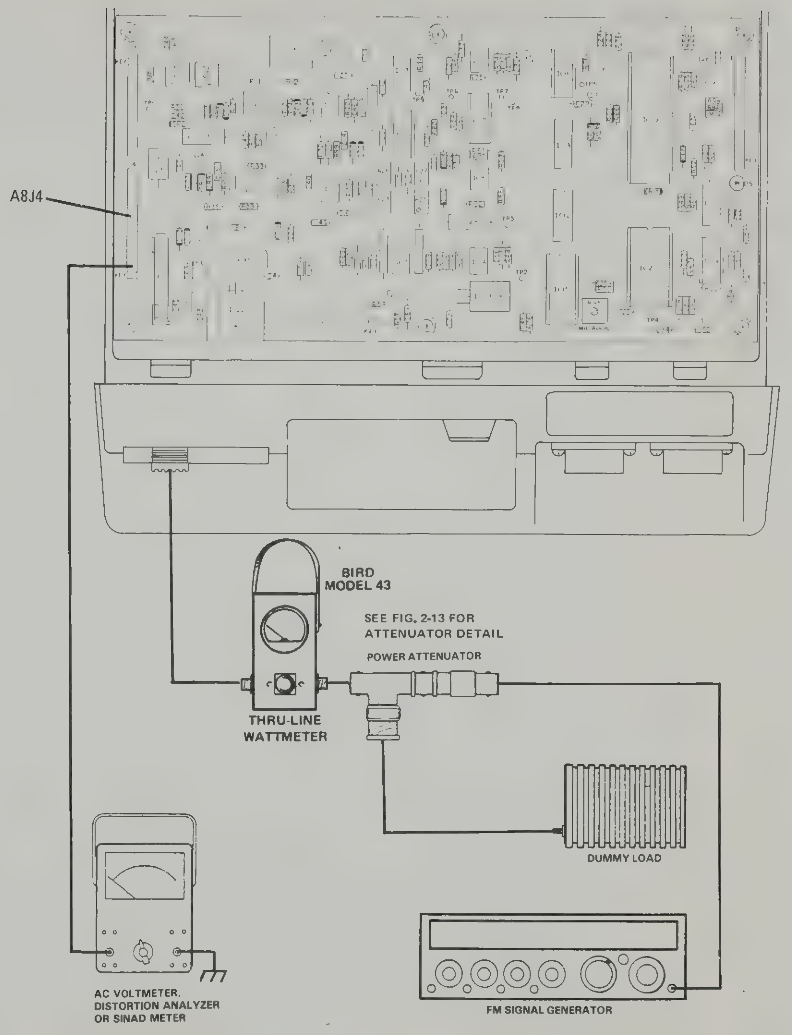
(e) Key Transmitter and check for proper power output. Readjust signal generator output level to obtain 20 dB indication on AC voltmeter. Record signal generator output level less attenuation factor. The Receiver 20 dB quieting sensitivity should be 0.50 μV or less with Transmitter on.

*Calibrated attenuator – any attenuator may be calibrated by first measuring the Receiver sensitivity (either SINAD or quieting) directly at the antenna connector and then measuring it through the attenuator.

The attenuation in dB (at the frequency measured) can be calculated as follows:

$$dB = 20 \log \frac{V_2}{V_1}$$

where V_1 = direct sensitivity in μV
V_2 = attenuated sensitivity in μV



AUDIO OUTPUT POWER AND DISTORTION MEASUREMENT

(a) Disable Transmitter by disconnecting wire at A2E3.

(b) Set FM signal generator for desired channel frequency with output level of 1.0 mv and modulation of 1.0 KHz. Set deviation at $\pm$ 3.0 KHz.

(c) Connect distortion analyzer to test point A8J4-6.

(d) Adjust Volume control A8R1 for an audio output of 1.0 volt RMS.

(e) Distortion should be less than 3 percent.

(f) Connect distortion analyzer across 8-ohm load at cradle speaker connector J03-1,2.

(g) Adjust cradle speaker control for 2.83 volts RMS (1 watt).

(h) Distortion should be less than 3 percent.

(i) Reconnect wire to A2E3.

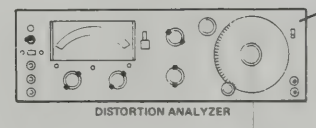


Figure 4-10. Receiver Performance Tests

NOTE

Unless otherwise indicated, the following steps apply to both the UHF and VHF Transceivers.

1. Set Power Supply output at + 13.6 volts dc. Insure that it does not fall below + 13.6 during the Transmitter alignment

2. At Control Unit, select manual operation, and center channel.

3. Connect dummy load to antenna connector J1 and DC Voltmeter to A10A2TP1.

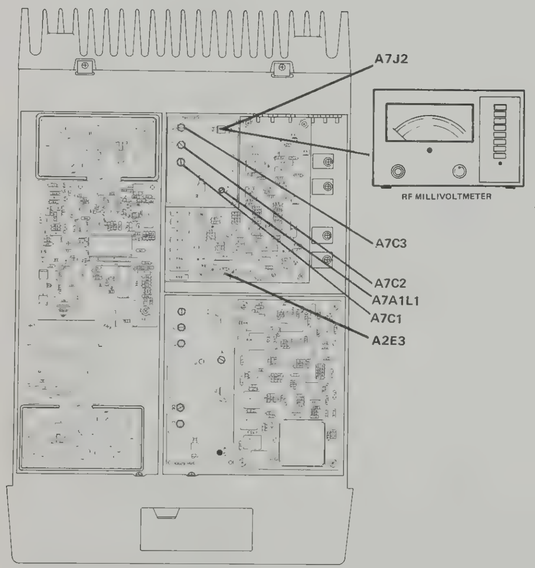
4. Key Transmitter. Slowly adjust trimmer A10A1C14 until indicator A10A2DS1 or A8DS1 goes out.

5. Fine adjust trimmer A10A1C14 for + 5.6 volt dc indication at A10A2TP1. Unkey Transmitter.

NOTE

When indicator A10A2DS1 or A8DS1 is on, there will be no transmission.

6. Disconnect test equipment.



7. UHF/VHF Exciter Alignment

UHF:

(a) Select a midchannel in frequency range to be covered at the Control Unit.

(b) Remove Tx control line at E3 on PA Control Module A2.

(c) Disconnect PA input plug A1P1 from Exciter output jack J2.

(d) Connect rf voltmeter with 50-ohm probe to Tx Exciter output jack J2.

(e) Key Transceiver and adjust Tx tripler output tune capacitors C1, C2, and C3, and Tx tripler input tune A1L1 for maximum indication on rf voltmeter.

(f) Repeat adjustment until no further improvement is possible. Normal output is slightly over one volt. Unkey Transceiver.

(g) Reconnect PA input plug A1P1 to Tx Exciter output jack J2.

(h) Reconnect Tx control line at E3 on PA Control Module.

VHF:

(a) Select a midchannel in frequency range to be covered at Control Unit.

(b) Disconnect PA input plug A1P1 from Tx Exciter Module output jack J2.

(c) Connect a 50-ohm load, or if available, an rf voltmeter with 50-ohm probe to Tx Exciter Module output jack J2.

(d) Connect dc voltmeter between TP2(+) and TP1(–). Use one volt range.

(e) Key Transmitter. Adjust inductor L5 for maximum meter indication at TP1 and TP2. Adjust C15 for maximum meter indication and C18 for minimum meter indication. Then adjust C21 for maximum meter indication. (Ensure that this order is followed.)

(f) Unkey Transmitter. Use rf voltmeter for the rest of procedure. If unavailable, connect a dc voltmeter between TP3 (+) and TP4 (–). Select range which provides full meter deflection.

(g) Key Transmitter. Adjust trimmers C21, C18, C15 and inductor L5 for maximum meter indication at Exciter Module output.

(h) Readjust trimmer C18 for minimum meter indication. Increase the meter sensitivity for this measurement.

(i) Readjust trimmer C21 and C15 for maximum meter indication. Use extreme care in performing this step for the new maxima are close in level and position to the maxima determined prior to this step.

(j) Readjust trimmer C18 for maximum meter indication. A voltage indication of approximately 3V (rf or dc) indicates a correct nominal output of 180 mW.

(k) Unkey Transmitter. Disconnect test equipment. Reconnect PA Drive (RF Out) at Tx Exciter output jack J2.

8. Disconnect RF Voltmeter. Reconnect A1P1 to A7J2.

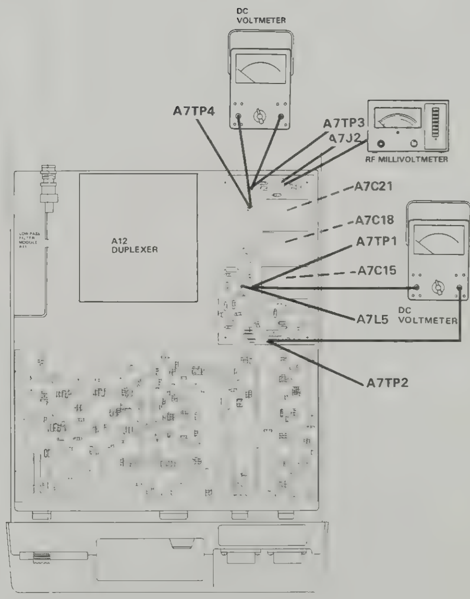


Figure 4-11. Transmitter Alignment Procedure (Sheet 1 of 3)

9. Connect Wattmeter and dummy load to antenna connector J1. Connect DC Voltmeter to test point A2J2-2.

10. UHF:
Set trimmers A1C1, A1C44 and A1C45 to midrange.

VHF:
Set trimmers A1C31 and A1C32 to midrange.

11. Set current limiter control A2R23 and power out control A2R19 fully counterclockwise.

12. Key Transmitter. Adjust PA supply control A2R33 for +12.5 volts dc indication at A2J2-2. Unkey Transmitter. Rotate A2R23 full clockwise.

13. UHF:
Key Transmitter. Adjust trimmers A1C1, A1C44 and A1C45 for maximum Wattmeter indication. Repeat until indication stabilizes.

VHF:
Key Transmitter. Adjust trimmers A1C31 and A1C32 for maximum Wattmeter indication. Repeat until indication stabilizes.

14. Key Transmitter and adjust power out control A2R19 to desired output level (25 to 50 watts for VHF, or 15 to 30 watts for UHF).

15. UHF:
Adjust trimmers A1C44 and A1C45 for maximum Wattmeter indication.

VHF:
Adjust trimmers A1C31 and A1C32 for maximum Wattmeter indication.

16. Repeat steps 13 and 14 until indication is within 5 percent of desired power output.

17. Adjust current limiter control A2R23 until Wattmeter indication just begins to decrease. Unkey Transmitter.

18. Disconnect test equipment.

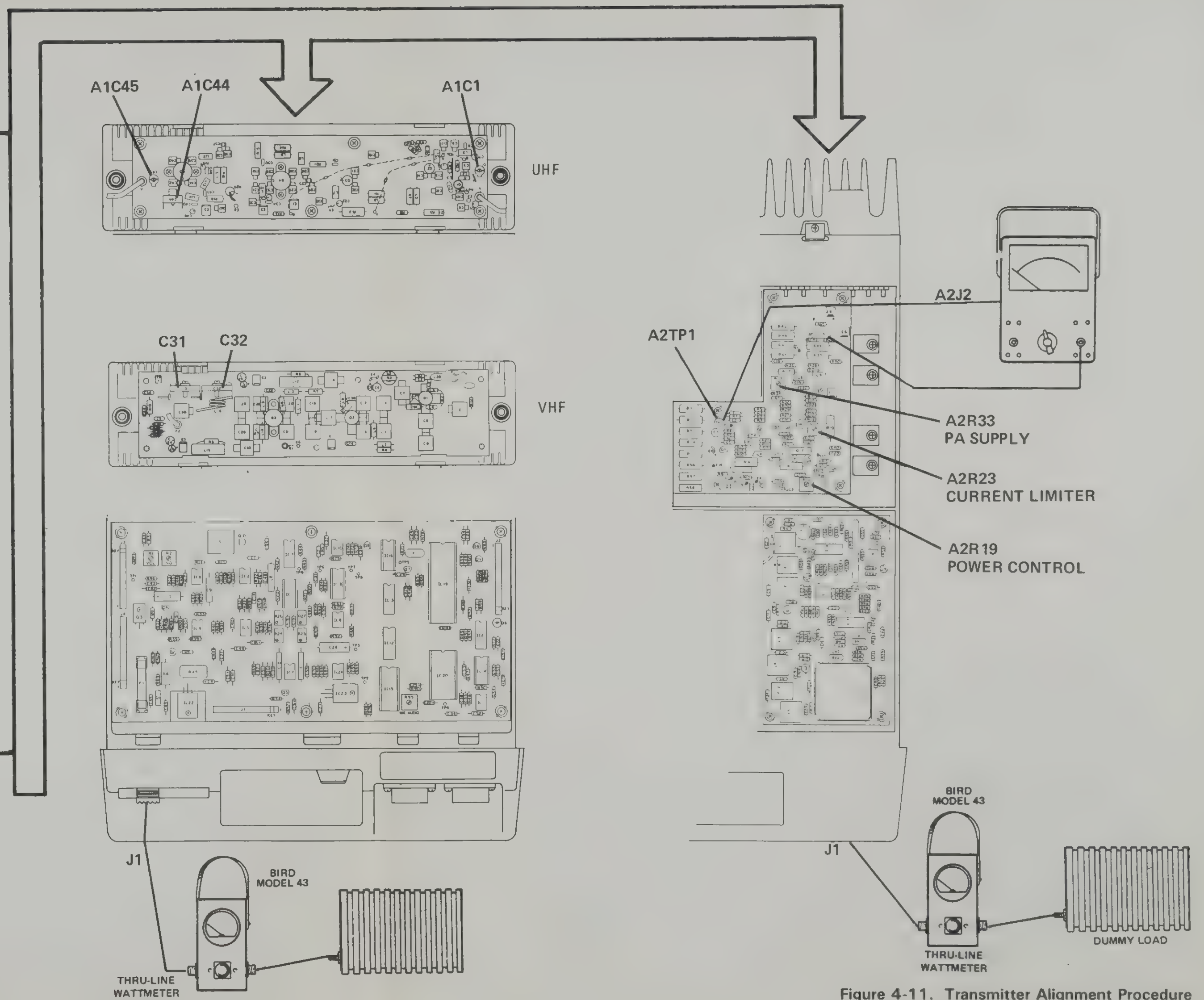


Figure 4-11. Transmitter Alignment Procedure (Sheet 2 of 3)

19. Connect deviation meter through attenuator to dummy load.

20. Set control A9R22 fully clockwise.

21. On Control Unit, enter test mode, select manual mode and center channel. See section G of this chapter for test mode operation.

22. Press [RCL] [7] to generate 1 KHz test tone.

NOTE

When the test tone is generated, the Control Unit cannot perform any other keyboard operations. Test tone will automatically terminate after approximately one minute. Within that time, the test tone can be terminated by hanging up the handset.

23. Key Transmitter and set transmitter deviation control A10A2R26 for 4.5 KHz deviation.

24. Depress hook switch to terminate test tone. Press PTT bar and whistle/speak into microphone. Average deviation should be between ±3 and 3.5 KHz and peak deviation must not exceed ±5 KHz. If peak voice deviation is greater than 5 KHz, decrease A10A1R26 setting.

25. If average deviation is not within limits specified in Step 24. adjust mic audio gain control A8R95.

26. Disconnect test equipment.

27. Connect frequency counter through 40dB power attenuator to antenna connector J1.

28. Select Manual mode and any channel.

29. Key Transmitter. Adjust trimmer A9C37 for Tx channel frequency (±100 Hz). Unkey Transmitter.

30. Disconnect test equipment.

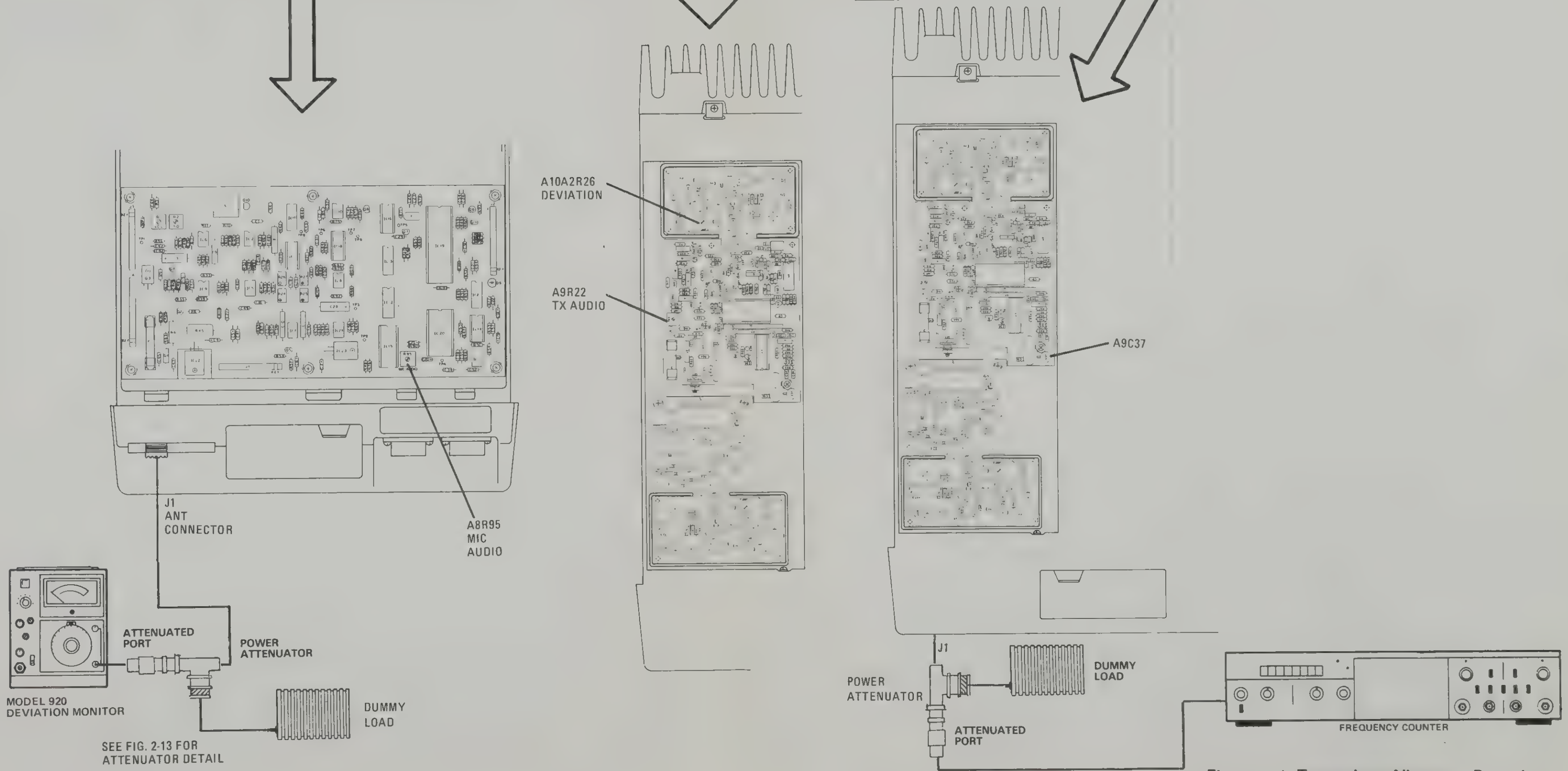


Figure 4-11 Transmitter Alignment Procedure (Sheet 3 of 3)

UHF DUPLEXER A12 ALIGNMENT

CAUTION

The UHF Duplexer uses a fixed tensioning device to preload the adjustment screws. Any attempt to adjust this tensioning device may impair its function.

(a) Connect dummy load to antenna connector J1. Disconnect COAX W6 from A12J1. Connect rf voltmeter with 50-ohm probe to A12J1. Secure probe to chassis with heavy tape.

(b) Remove four screws securing Duplexer.

(c) Lift up Duplexer for access to the three Rx alignment screws.

(d) On Control Unit, select center channel. Key Transmitter. Adjust RX Alignment screws for minimum indication on rf voltmeter. Repeat until indication stabilizes at less than 8 mV RMS. Unkey Transmitter.

(e) Disconnect rf voltmeter. Reconnect COAX W6 to A12J1.

(f) Disconnect Low-Pass Filter Module A11 cable from A12J3.

(g) Set FM Signal Generator at center receive channel frequency with no modulation at 100 mV output level.

(h) Connect FM Signal Generator to A12J3.

(i) Connect dc voltmeter to test point A8J4-16.

(j) Adjust TX Alignment screws for minimum indication on dc voltmeter. Repeat until indication stabilizes.

(k) Disconnect FM Signal Generator and dc voltmeter. Reconnect Low-Pass Filter Module cable to A12J3.

(l) Secure Duplexr to chassis.

VHF DUPLEXER A12 ALIGNMENT

(a) Disconnect A12P2 from A11P1. Connect A12P2 to a dummy load. Disconnect A1P2 from A12P3. Connect A11P1 to A1P2. Connect Transceiver J1 through a test cable to A12P3. Connect a RF voltmeter with a 50 ohm probe ground, and minimize stray pick up, secure the probe to the chassis with heavy tape.

(b) Loosen lock nuts on two Rx alignment rods just enough to allow adjustment.

(c) On Control Unit, select center channel. Key Transmitter. Adjust rods for minimum indication on rf voltmeter. Repeat until indication stabilizes at less than 8 mV RMS. Carefully tighten lock nuts to prevent degradation of alignment. Unkey Transmitter.

(d) Disconnect rf voltmeter and test cable from A12P3 to Transceiver J1. Reconnect A12P1 to A4J1 and A12P2 to A11P1.

(e) Connect a dummy load to Antenna Connector J1.

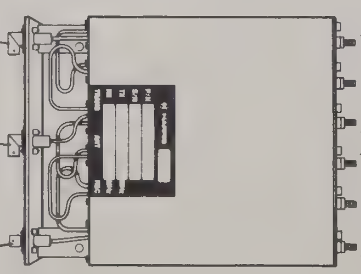
(f) Set FM Signal Generator at center receive channel frequency with no modulation at 100 mV output level.

(g) Connect FM Signal Generator to A12P3.

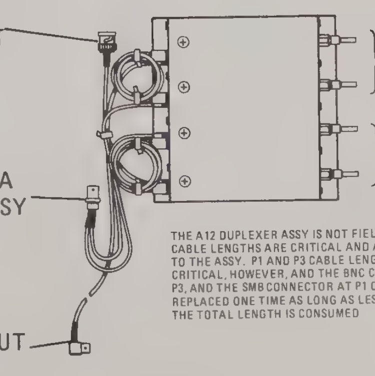
(h) Connect dc voltmeter to test point A8J4-16.

(i) Loosen lock nuts on two Tx alignment rods just enough to allow adjustment. Adjust rods for minimum indication on dc voltmeter. Repeat until indication stabilizes. Carefully tighten lock nuts to prevent degradation of alignment.

(k) Reconnect A12P3 to A1P2.

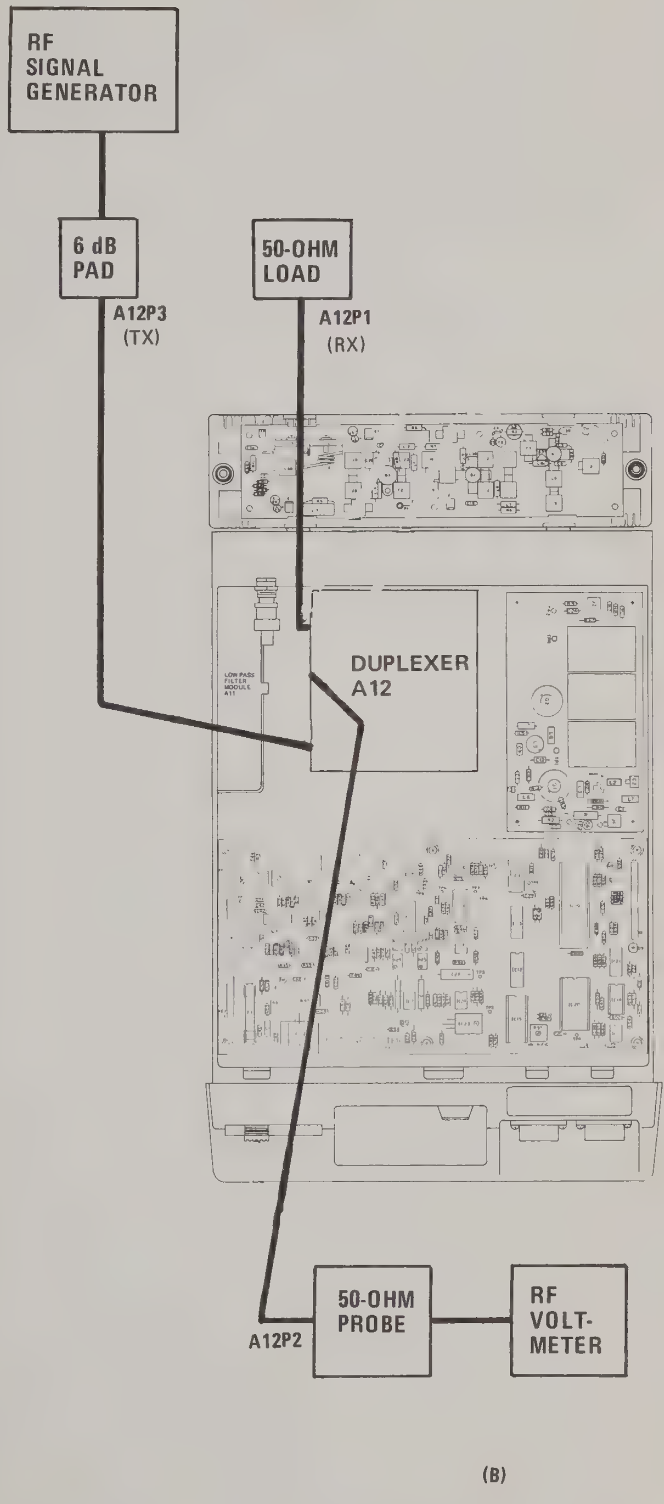


UHF DUPLEXER



VHF DUPLEXER

Figure 4-12. Duplexer Alignment Procedure



VHF

Figure 4-13 Duplexer Insertion Loss Measurement

TEST EQUIPMENT REQUIRED

Hewlett-Packard Model HP-8640 or equivalent.

RF Voltmeter, Boonton Model 92-C or equivalent.

Pad, 6 dB, 50-ohm.

Load, 50 ohm, Bird Model 8135 or equivalent.

RECEIVE CAVITY

(a) Set generator controls to receive center channel frequency.

(b) Connect Duplexer to test equipment as shown in figure 4-13(A).

(c) Set generator output at 100 mV as indicated on RF Voltmeter.

(d) Disconnect RF Voltmeter/probe and signal generator/pad from the Duplexer. Connect the probe to the pad.

(e) The RF Voltmeter indication should not increase more than 0.8dB VHF, or 1.5dB UHF. If the indication increases more than allowed, refer to Duplexer alignment procedure.

TRANSMIT CAVITY

(a) Set generator controls to center channel transmit frequency.

(b) Connect Duplexer to test equipment as shown in figure 4-13(B).

(c) Set generator output at 100 mV as indicated on RF Voltmeter.

(d) Disconnect RF Voltmeter/probe and signal generator/pad from the Duplexer. Connect the probe to the pad.

(e) The RF Voltmeter indication should not increase more than 0.8dB VHF or 1.5dB UHF. If the indication increases more than allowed, refer to Duplexer alignment procedure.

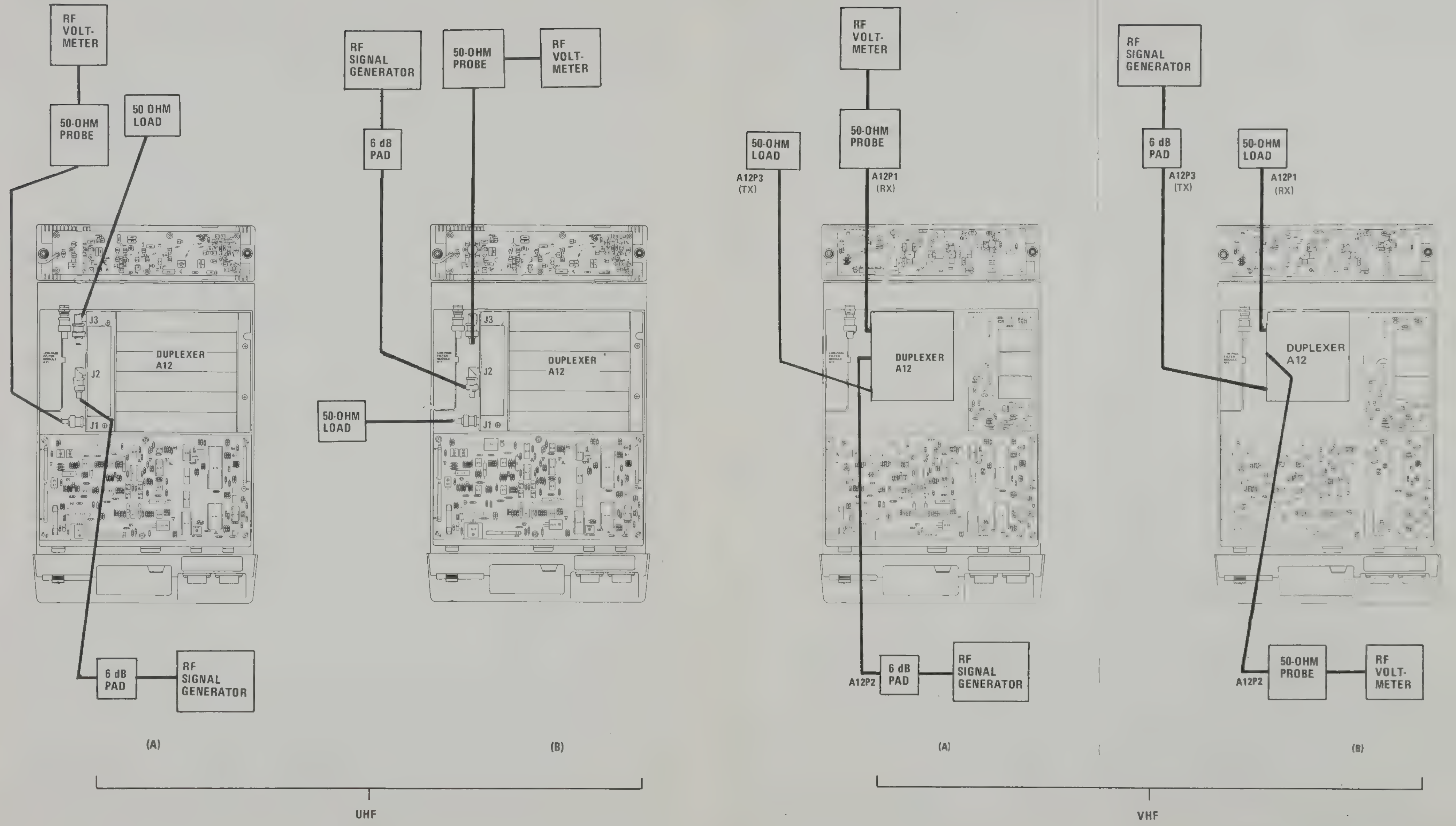
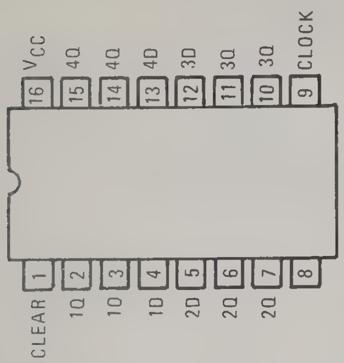
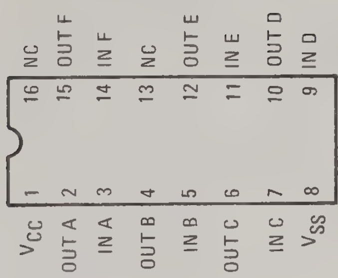


Figure 4-13 Duplexer Insertion Loss Measurement

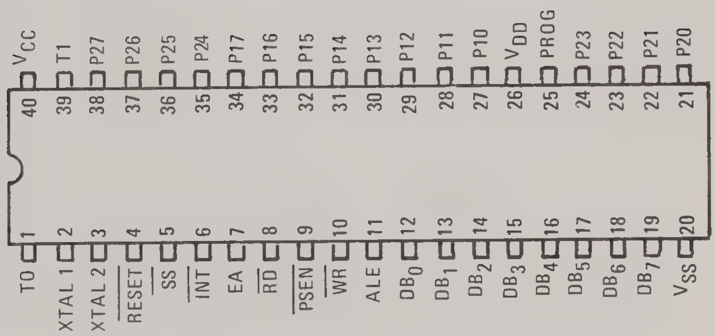
SN74LS175 (A8U12, A8U13)



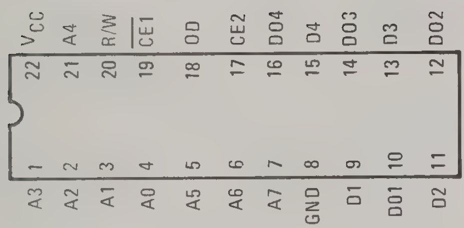
CD4049BE (A8U18)



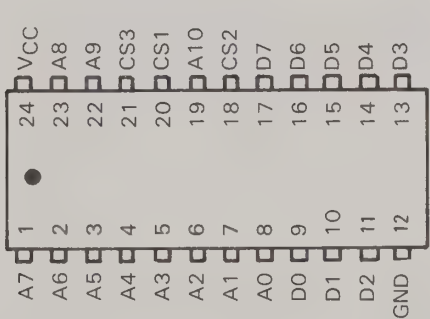
8035 (A8U19)



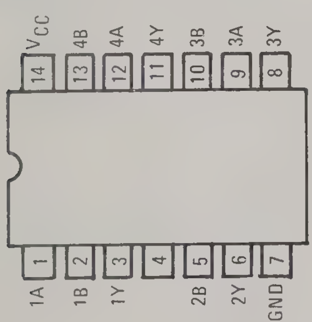
P5101L (A8U15)



6624-1187 (A8U20)



SN74LS26N (A8U17, A8U21)



MC7805CT (A8U22, A8U23)
UA 7885 (HANDSET U7)

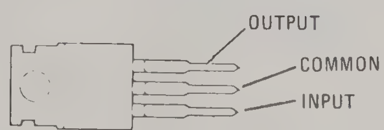
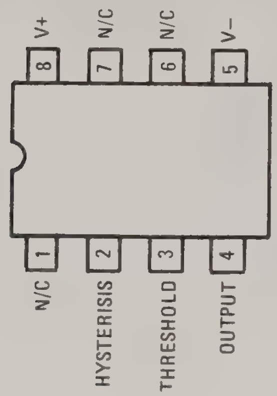
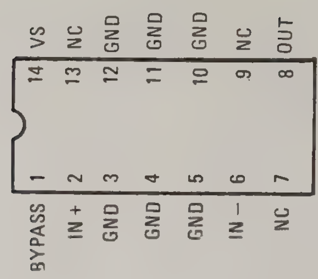


Figure 4-14. Integrated Circuit Package Information
(Sheet 1 of 4)

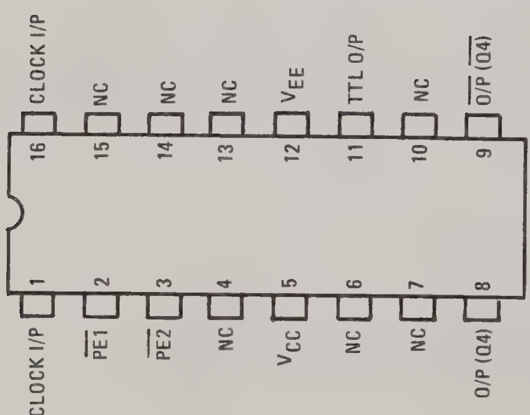
ICL8211CPA (A8U24)
ICL8212CPA (CRADLE U2)



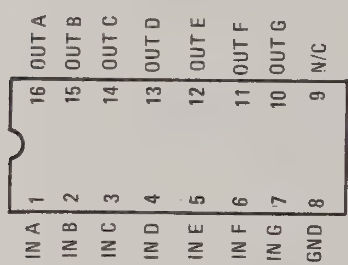
LM380 (CRADLE U1)



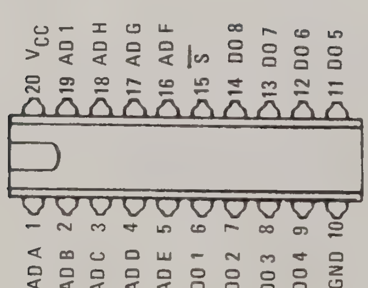
SP8647B (A9U2)



ULN-2004AN (HANDSET U6)



10029-0997 (A9U3)



4051BE (HANDSET U5)

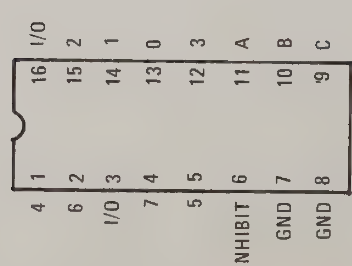
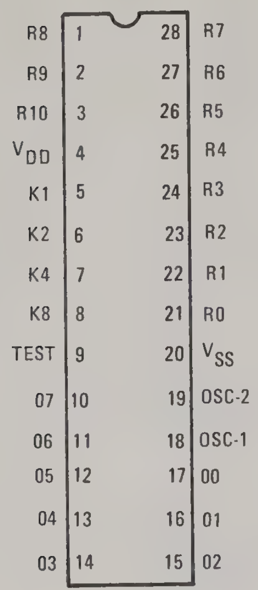
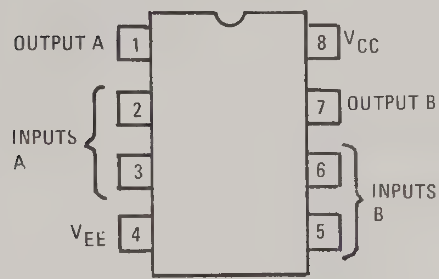


Figure 4-14 . Integrated Circuit Package Information
(Sheet 2 of 4)

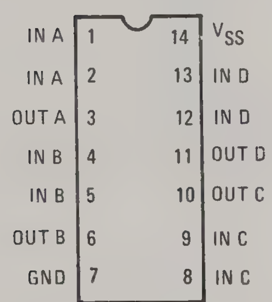
TMS-1000 (HANDSET U3)



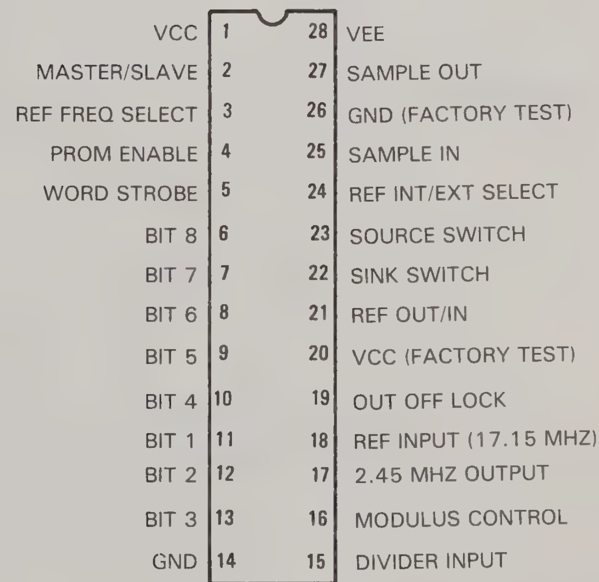
MC1458CP (A8U1, A8U8, A8U10, HANDSET U4)
LM358N (A3U6, A3U7)
CA3240E (A3U2, A8U2, A8U5-A8U7, A8U9)



4001AE (HANDSET U1)



HSD 3252 (A6U1 and A9U1)



4040BE (HANDSET U2)

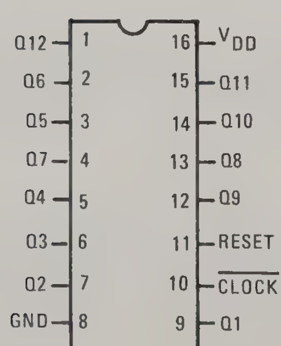
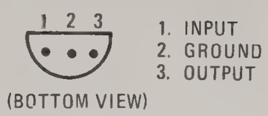


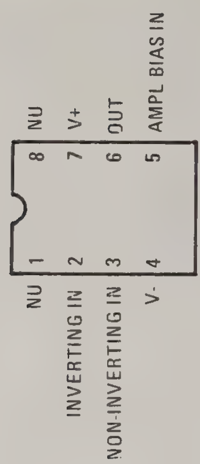
Figure 4-14. Integrated Circuit Package Information
(Sheet 3 of 4)

MC78L08ACP (A2U1, A3U5)

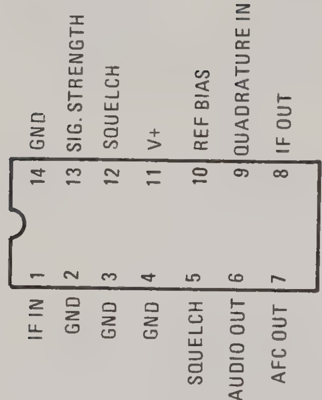
LM240LAZ5.0 (A2U2, A9U4)



CA3080E (A3U4)

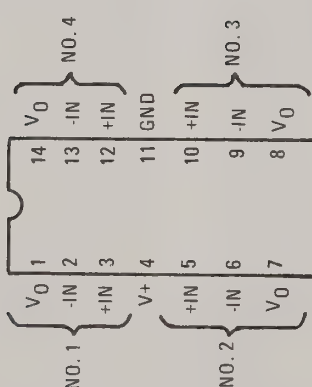


CA3089E (A3U1)



CD4066BE (A8U11, A8U14)

CA324E (A3U3)



SP-8690B (A6U2)

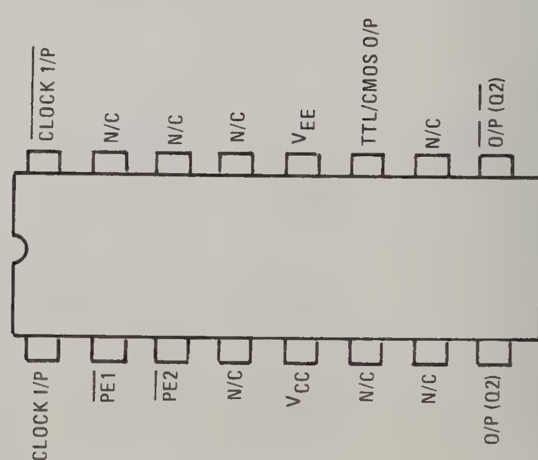
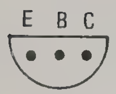


Figure 4-14. Integrated Circuit Package Information
(Sheet 4 of 4)

TRANSISTOR LEAD IDENTIFICATION

(BOTTOM VIEWS SHOWN)



TO-92

A2Q1
A2Q2
A2Q3
A2Q6
A2Q7
A3Q3
A4Q2 (VHF)
A4A2Q2 (UHF)
A5A1Q2
A5A1Q4
A5A1Q5
A5A1A6
A5A1Q7
A5A1Q9
A5A1Q10
A5A2Q1
A5A2Q2
A5A2Q3
A5A2Q5
A5A2Q6
A5A2Q7
A5A2Q8
A5A2Q9
A5A2Q10
A5A2Q11
A5A2Q12
A5A2Q13
A6Q1
A6Q2
A6Q3
A6Q4
A6Q5
A6Q6
A6Q7
A6Q8
A6Q9
A6Q10
A7A1Q2 (UHF)
A8Q6
A8Q7
A8Q10
A9Q2
A9Q3
A9Q5
A9Q6
A9Q9
A9Q10
A9Q11
A9Q12
A9Q13
A9Q14
A9Q15
A9Q16
A9Q14
A9Q18
A9Q19
A9Q20
A9Q22
A10A1Q2
A10A1Q4
A10A1Q5
A10A1Q6
A10A1Q7
A10A1Q9
A10A1Q10
A10A2Q1
A10A2Q2
A10A2Q3
A10A2Q5
A10A2Q6
A10A2Q7
A10A2Q8
A10A2Q9
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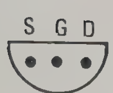
A10A2Q11
A10A2Q12
A10A2Q13

A3Q1
A3Q2
A4Q1 (VHF)



A5A1Q3
A10A1Q3

Figure 4-15. Transistor Lead Identification (Sheet 1 of 3)

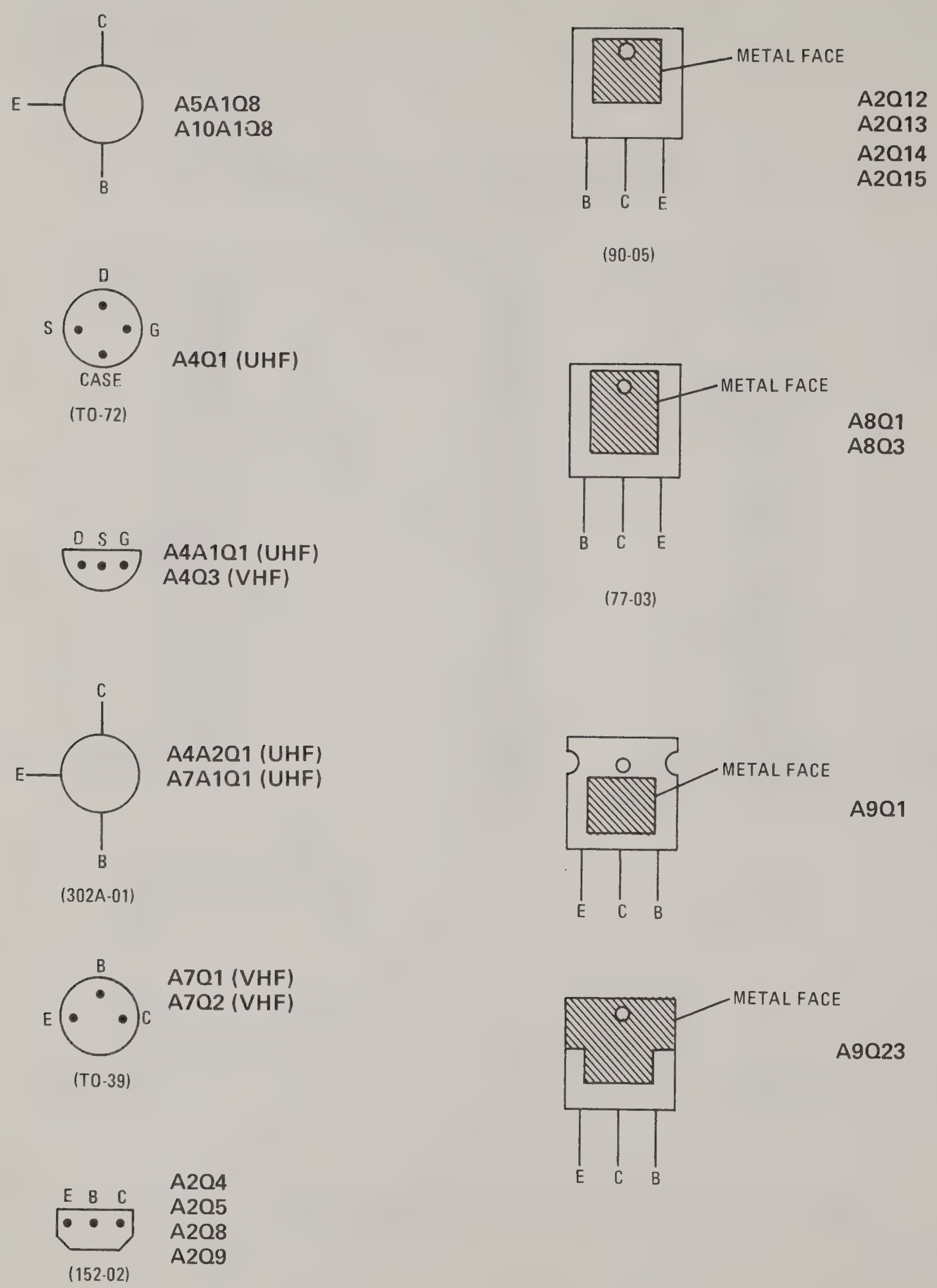
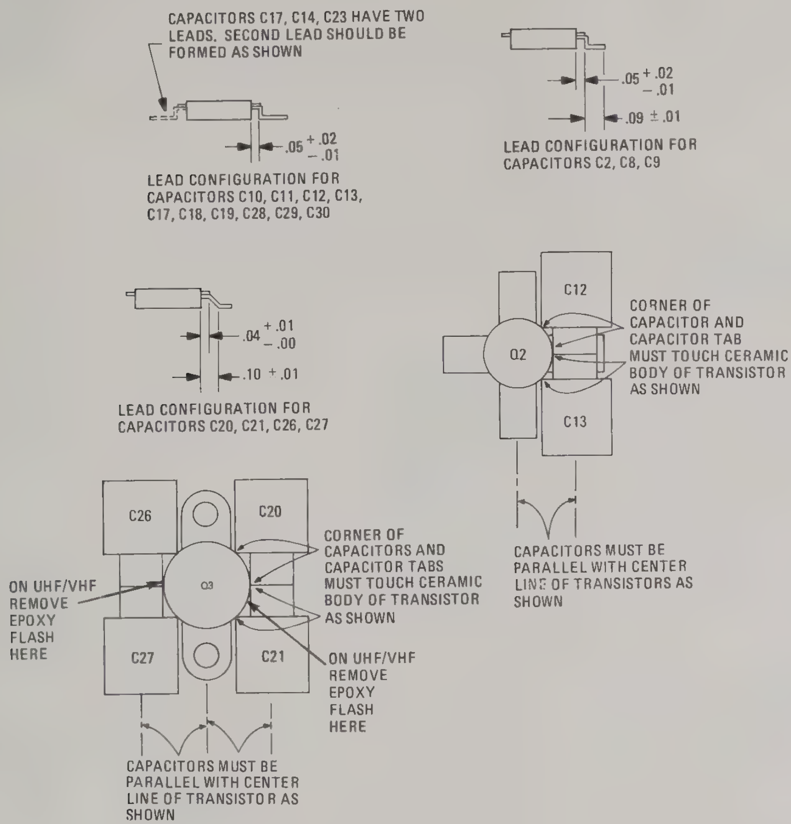
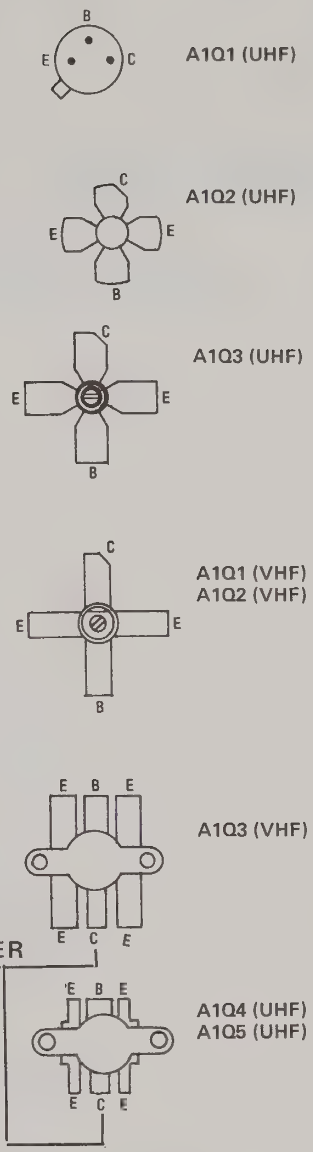


Figure 4-15. Transistor Lead Identification (Sheet 2 of 3)

CAPACITOR LEAD PREPARATION AND ORIENTATION FOR VHF PA. CAPACITORS FOR UHH PA HAVE PREFORMED LEADS AND LOCATING LEGS.



PA TRANSISTOR OUTLINES (BOTTOM VIEWS)



CAUTION

Leads on replacement transistor must be trimmed in accordance with dimensions shown. Lead trim for new transistors should be the same as the part it replaces.

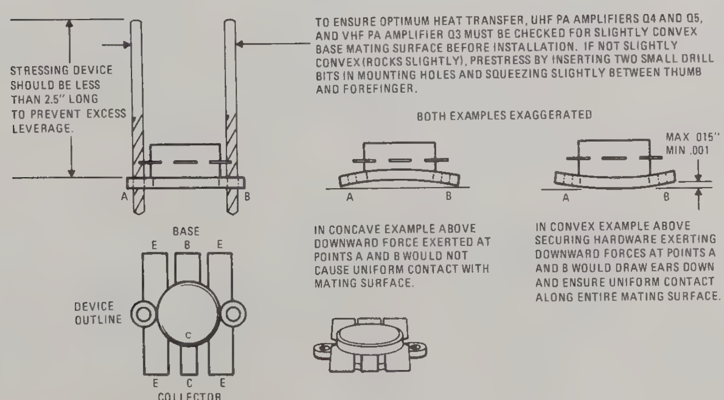
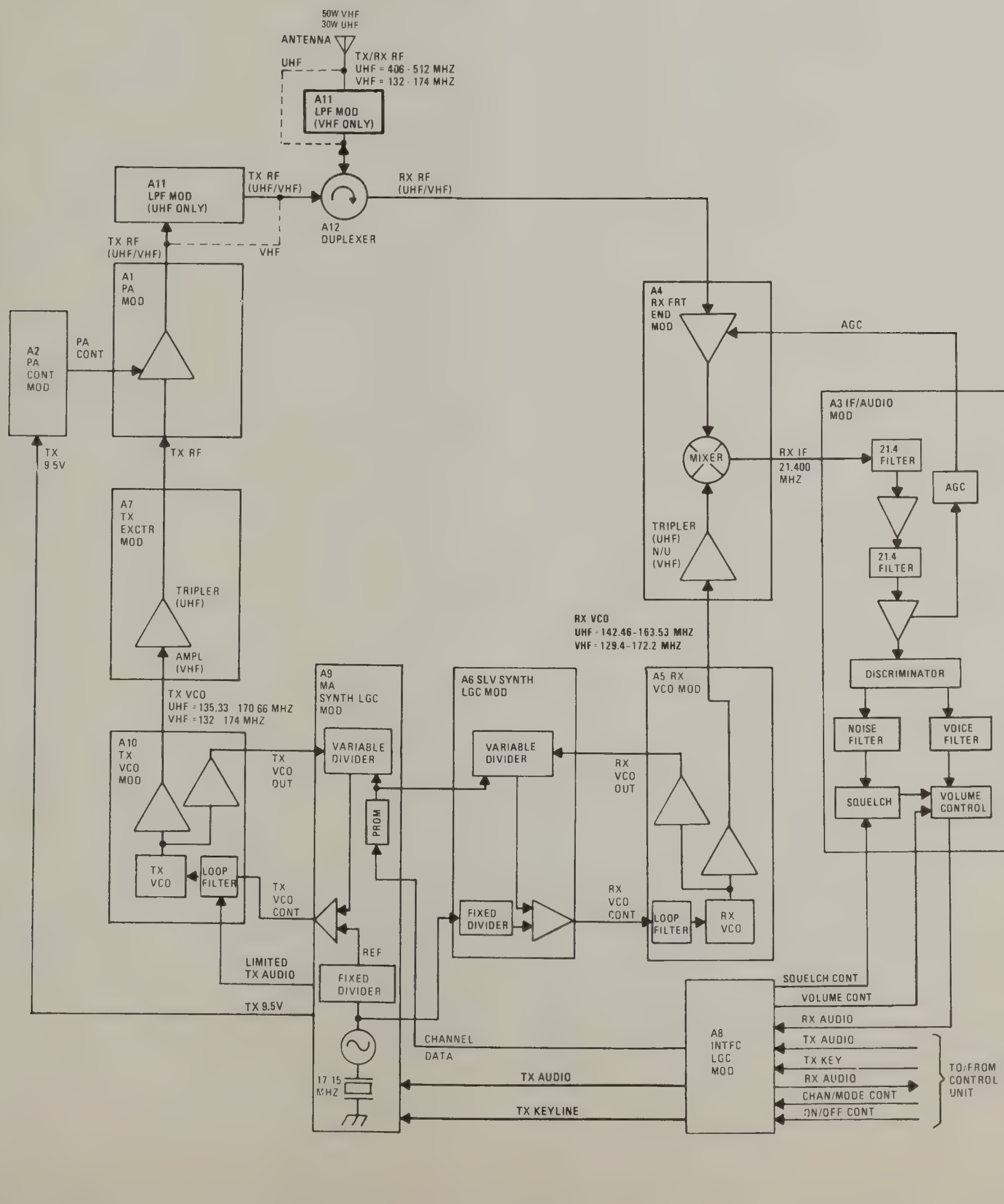


Figure 4-15. Transistor Lead Identification (Sheet 3 of 3)

A
Chassis

UHF DUPLEX TRANSCEIVER 10029-1000
VHF DUPLEX TRANSCEIVER 10029-2000



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1. GENERAL DESCRIPTION

1.01 The Alpha 2000 is a multi-channel FM Transceiver designed for full duplex operation in either UHF (406 to 512 MHz) or VHF (132 to 174 MHz) bands. As many as 128 transmit channels and 128 independent receive channels may be programmed into the synthesizer, although normally only 32 channels can be adressed by the Alpha 40 Control Unit. In the standard car telephone, channel information is divided into four 32-channel groups; VHF TELCO, UHF TELCO, VHF RCC, UHF RCC. (See Table 1-2 in Chapter 1, General Information, for more detail.) Jumpers A8JMP2 and A9JMP3 program the Transceiver for the proper system (channel group) and the programming in Code Plug (PROM) A8U16 controls which channels in that group can be accessed by the Alpha 40 Control Unit. The Transmitter frequencies are generated by a synthesizer operating in the VHF frequency range with a tripler added to both the receive and transmit portions for UHF operation. Audio signals are injected into the transmit (TX) synthesizer control loop to modulate the carrier frequency. Audio processing circuitry in the TX synthesizer provides deviation limiting and produces the proper pre-limiter and post-limiter audio shaping.

1.02 VHF and UHF Transceivers both use the same die-cast chassis and die-cast hinged PA heat sink. The Interconnecting Wiring, IF/Audio, Interface Logic, PA Control, Master and Slave Synthesizer Modules and the Alpha 40 Control Unit are also common to both Transceivers.

1.03 The Alpha 2000 VHF Transceiver also includes VHF Tx Exciter, Power Amplifier (PA), Receiver Front End, Duplexer, TX and Rx VCO Modules. All VHF Modules are split into two bands: 132 to 150.8 MHz and 150.8 to 174 MHz. One VHF Low-Pass Filter covers the 132 to 174 MHz range.

1.04 The Alpha 2000 UHF Transceiver also includes a UHF Power Amplifier (PA) and Tx VCO Module, each of which is split into two bands: 406 to 470 MHz and 450 to 512 MHz. The UHF Receiver Front End, Tx Exciter, Rx VCO, and Low-Pass Filter Modules cover the entire UHF range of 406 to 512 MHz. The standard UHF Duplexer covers 450 to 470 MHz. Other ranges are available.

1.05 The Transceiver is designed for operation in a nominal +13.6 volt ±20% negative ground electrical system. Current drain is approximately 13.5 amps maximum at full transmit output and 0.5 amp in the receive mode. An in-line fuse in the main power cable protects the Transceiver from damage due to an internal short circuit. High and low current fuses within the Transceiver take over if the in-line fuse is omitted during installation. A power diode on the front panel works in conjunction with fuses to protect the Transceiver from reverse polarity damage.

1.06 The Transceiver is configured as a trunk (for mobile units) or remote mounted unit. The external bottom cover bolts to the mounting surface. The Transceiver chassis slides into the bottom cover/mounting tray and locks into place with a key to form a theft/tamper resistant assembly. Antenna, power, and control connections are made via connectors on the front panel. (See Chapter 2, Installation, for more information.)

2. INTERFACE CONNECTIONS

A. Antenna and Power Interface

2.01 The antenna and power interface for all Transceivers is identical. (See Chapter 2, Installation, for further information.

B. Control Interface

2.02 The Transceiver is designed for adaptability to many different Control Unit interface options. This is accomplished by different types of Interface Logic Modules. Normally, the basic Transceiver contains either a 10029-0800 (for IMTS/MTS) or a 10029-0810 (for IMTS/2805) type Interface Logic Module which operates with the Harris Alpha 40 Control unit. The Control Unit has a red indicator lamp that lights when the Transceiver circuits are conditioned to activate the Transmitter. The Control Unit includes an adjustment control for receiver volume, a main power switch, and push buttons for selecting the operating channel and for telephone dialing. Operator access to the Transceiver is limited by an electronic lock that allows operation only after the equipment has been activated by a special user's code. The Control Unit also interlocks the Transceiver's transmit capability, with a controlled voltage (ignition switch in the vehicle) which prevents unauthorized use of the Transmitter. A more detailed description of the Alpha 40 Control Unit interfaces are presented in the A8 tab section.

3. TECHNICAL DESCRIPTION

3.01 The Transceiver features a die-cast aluminum integral front panel and chassis, and a separate die-cast rear panel. The chassis is iridited for good conductivity and resistance to corrosion. Design of the chassis and the shielding of internal covers, divide the chassis into five shielded compartments. Individually acting spring fingers on the internal covers, and finger spring stock on the rear panel, provide a consistent rf tight seal. Locking top and bottom external covers completes the mechanical package. A small dc and control harness passes through bulkhead bypass capacitors (C1-C6) to connect PA Module A1 and PA Control Module A2 at the rear of the Transceiver. All rf interconnections in the Transceiver are made using coaxial cable and SMB or BNC type connectors.

3.02 The Transceiver contains twelve basic modules which are described in detail in separate tab sections in this manual. Table 1 contains a list of these modules, their reference designators, nomenclatures, and abbreviated references.

TABLE 1

Transceiver Modules

REF DESIG	NOMENCLATURE	ABBREVIATION
A1	Power Amplifier Module	PA MOD
A2	Power Amplifier Control Module	PA CTRL MOD
A3	IF/Audio Module	IF/AUDIO MOD
A4	Receiver Front End Module	RX FRT END MOD
A5	Receiver VCO Module	RX VCO MOD
A6	Slave Synthesizer Logic Module	SLV SYNTH LGC MOD

TABLE 1. (Cont.)

REF DESIG	NOMENCLATURE	ABBREVIATION
A7	Transmit Exciter Module	TX EXCTR MOD
A8	Interface Logic Module	INTRFC LGC MOD
A9	Master Synthesizer Logic Module	MA SYNTH LGC MOD
A10	Transmit VCO Module	TX VCO MOD
A11	Low-Pass Filter Module	LPF MOD
A12	Duplexer	DPLXR

3.03 Located beneath the front handle of the chassis is reverse polarity diode CR1, fusible link F1 and filter L1/C7. If voltage of the wrong polarity is applied to the Transceiver power connector, CR1 will conduct, protecting the Transceiver and blowing the power cable fuse. If for any reason the power cable fuse does not blow, the fusible link F1 will open and protect the Transceiver. F1 may be repaired with 1.0-inch of #28 soft drawn copper wire. All modules except for the PA and PA Control Modules receive their battery voltage through filter choke L1 and across filter capacitor C7. The negative terminal of C7 is used as the main ground point for power wiring to prevent ground loops.

4. MAINTENANCE

A. General Information

4.01 All significant signal and control inputs and outputs are shown on the cover diagram and in Figures 3 and 4 in this tab section. All alignments and adjustments required to establish FCC operating requirements are made at the factory prior to shipment. Normally, it should not be necessary to repeat any of these adjustments unless there are component failures or unless readjustment becomes necessary for some other specific reason. (See Chapter 4, Maintenance, for an overall alignment procedure for the UHF and VHF Transceiver.)

B. Troubleshooting

4.02 Standard troubleshooting procedures (such as signal injection, signal, voltage, and resistance measurements) can be used to isolate a fault to a specific module or assembly. The receiver gain measurements, as well as the alignment procedure referenced before can be used to aid in troubleshooting. Once the fault assembly or module has been identified, refer to the specific tab section and use the schematics and component location diagrams to locate the faulty component.

5. PARTS LIST

A. Basic Chassis

5.01 The 10029-0050 basic chassis is used with both UHF and VHF Transceivers. Table 2 gives the parts list information for the chassis.

B. UHF Transceiver Chassis

5.02 The UHF Transceiver parts list information is given in table 3 while the component location information is shown in figure 1.

C. VHF Transceiver Chassis

5.03 The VHF Transceiver parts list information is given in table 4 while the component location information is shown in figure 2.

6. SCHEMATIC DIAGRAMS

A. UHF Transceiver Main Frame Schematic Diagram

6.01 Figure 3 is the schematic diagram for the UHF Transceiver Main Frame showing the interconnection between all subassemblies.

B. VHF Transceiver Main Frame Schematic Diagram

6.02 Figure 4 is the schematic diagram for the VHF Transceiver Main Frame showing the interconnection between all subassemblies.

TABLE 2

Chassis, Parts List

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
A	CHASSIS	10029-0050
C1	Capacitor, Feed-Thru, 120 PF	C05-0005-001
C2	Capacitor, Feed-Thru, 120 PF	C05-0005-001
C3	Capacitor, Feed-Thru, 120 PF	C05-0005-001
C4	Capacitor, Feed-Thru, 120 PF	C05-0005-001
C5	Capacitor, Feed-Thru, 120 PF	C05-0005-001
C6	Capacitor, Feed-Thru, 120 PF	C05-0005-001
C7	Capacitor, Electrolytic, 10,000 μF	C19-0010-103
CR1	Diode, IN3659R	CR-0384
F1	Fusible Link	10029-0082
F1R1	Resistor, Composition, 27 K ohm ± 5%, ½ W	R-1483
F1W1	Wire, Buss, No. 28	W-0925
L1	Filter, Choke	10029-0085
Q1–Q11	Not Used	
Q12	Transistor, 2N5986	Q-0427
Q13	Transistor, 2N5986	Q-0427
Q14	Transistor, 2N5986	Q-0427
Q15	Transistor, 2N5986	Q-0427
W1	Interconnect Cable Assy Includes replaceable items (1) J2, P/N J15-0003-000, and PINS MP–1265; (2) P2, PN J46-0016-116	10029-0091
W2	Interconnect Cable Assy	10029-0092
W3	Interconnect Cable Assy	10029-0093
W4	Interconnect Cable Assy	10029-0094

TABLE 2

Chassis, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
W5	Cable Assy, Power Includes replaceable items (1) J3 P/N J-0258 and PINS MP3555	
W6*	Cable Assy, Coax, Receiver to Duplexer	10029-0096
W7*	Antenna Connector Assy (Includes J1)	10029-0090
Z1 – Z6	Ferrite Bead	E-0088
	Cover Assy	10029-0080
	Mounting Tray	10029-0077
	Cable Assy, Battery - See Page 2-11	10029-0099
	Cable Assy, Control - See Page 2-11	10029-0098
	Alpha 40 Control Unit (Black)	10029-0700
	Alpha 40 Control Unit (White)	10029-0701
	Ancillary Kit	10029-0020
	Lock Assy	10029-0040
	Lock (Key P/N MP3653)	10029-0046
	Name Plate, HARRIS	Z10-0025-002

*UHF Only

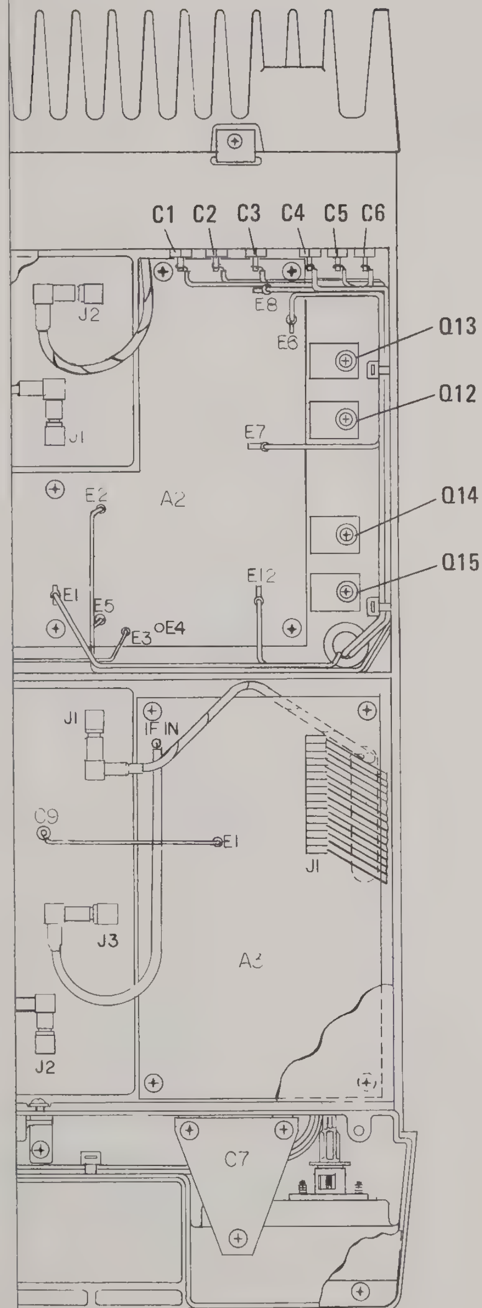


Figure 1. UHF Transceiver Chassis

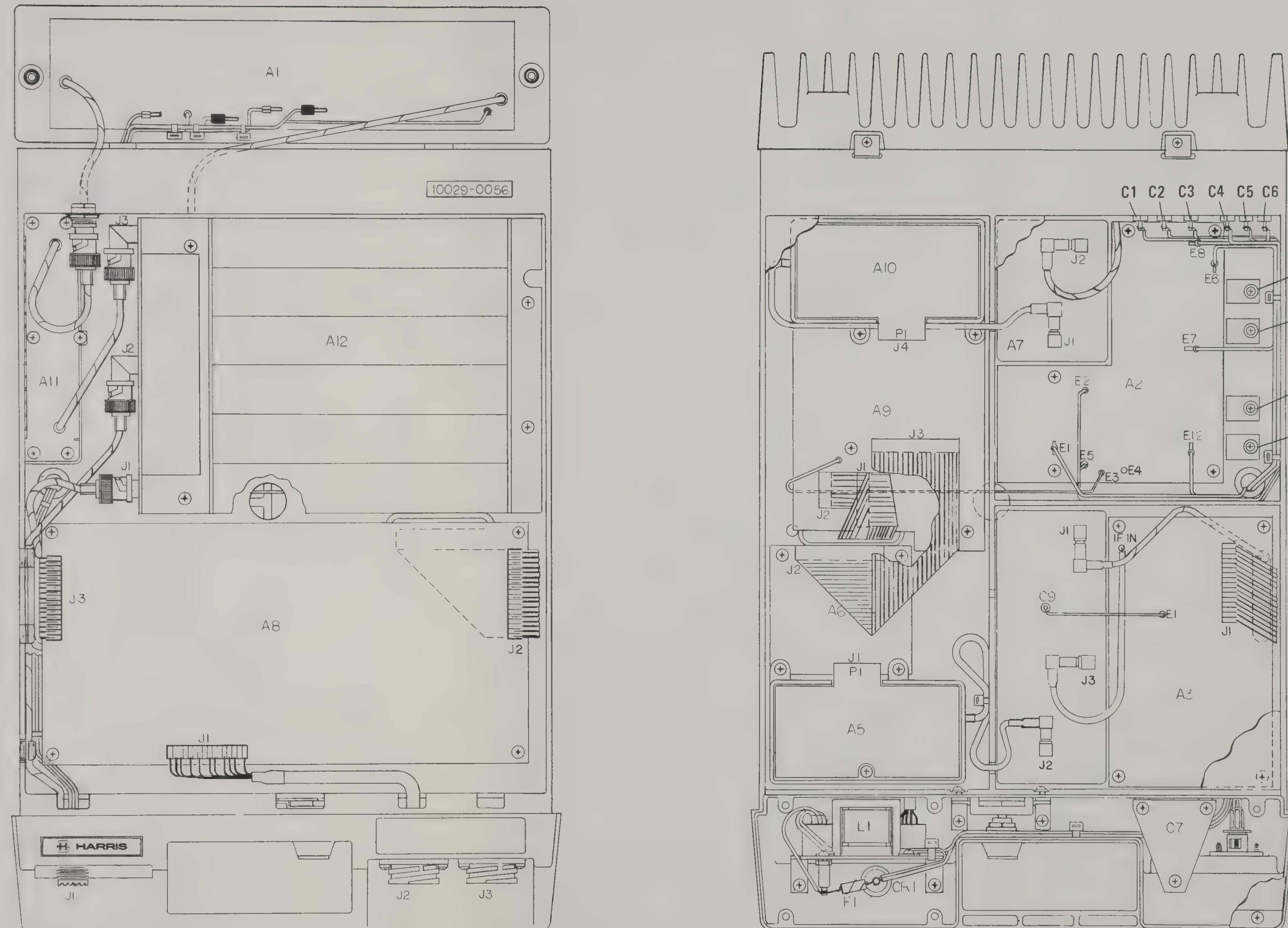


Figure 1. UHF Transceiver Chassis

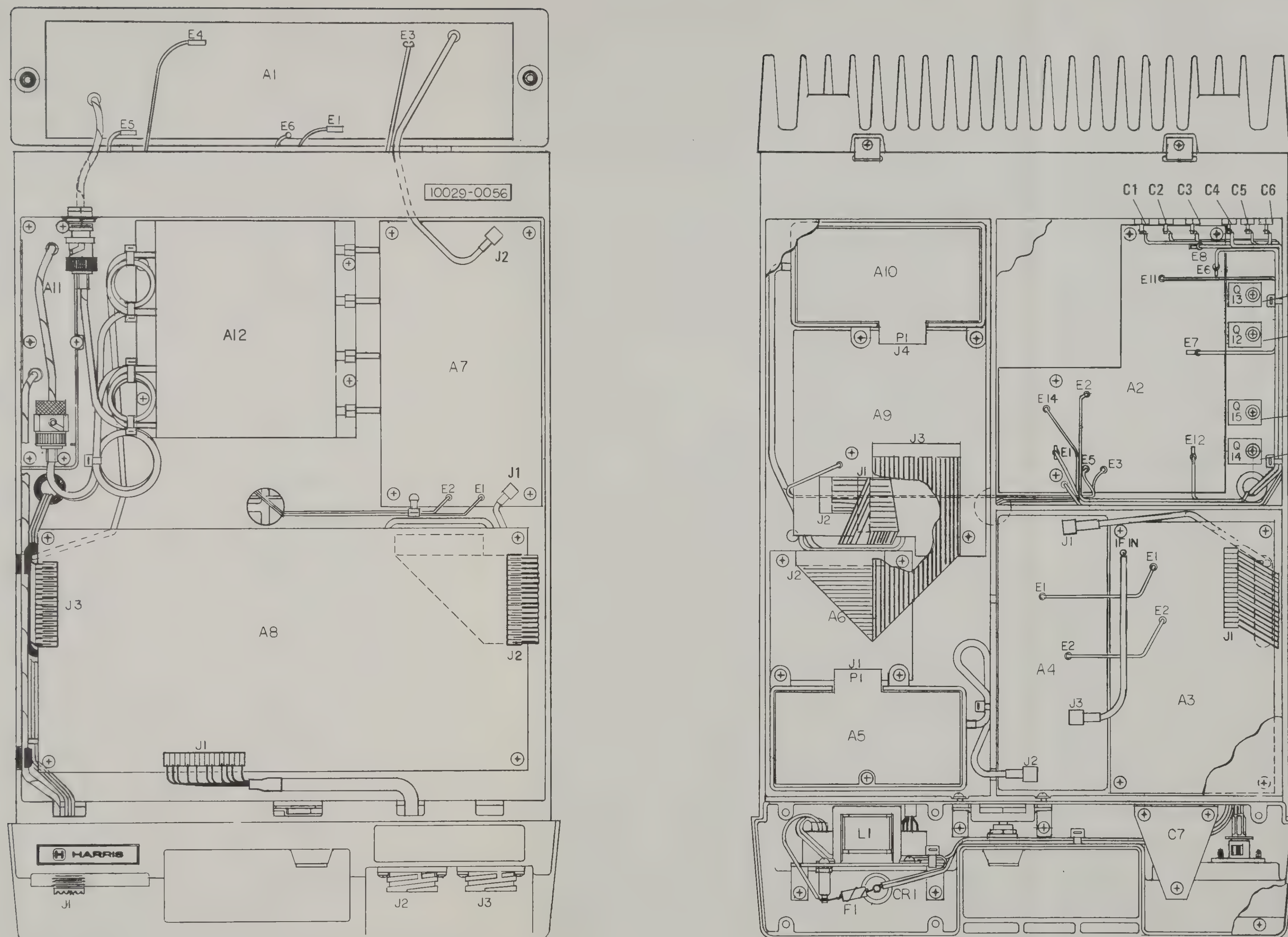
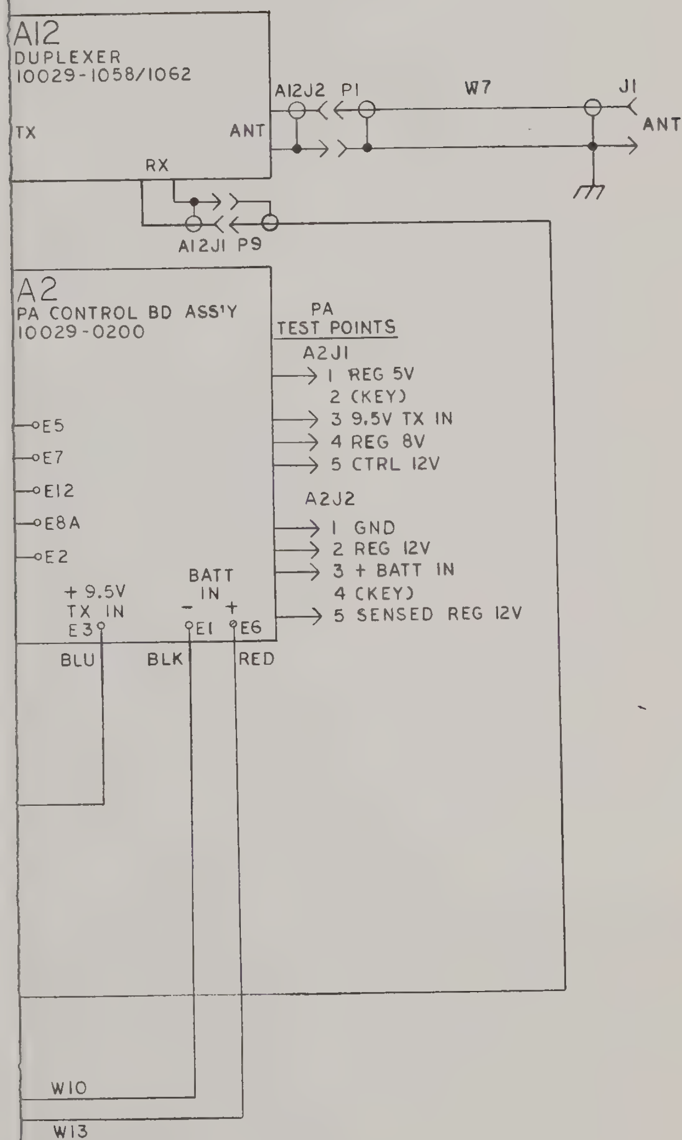


Figure 2. VHF Transceiver Chassis

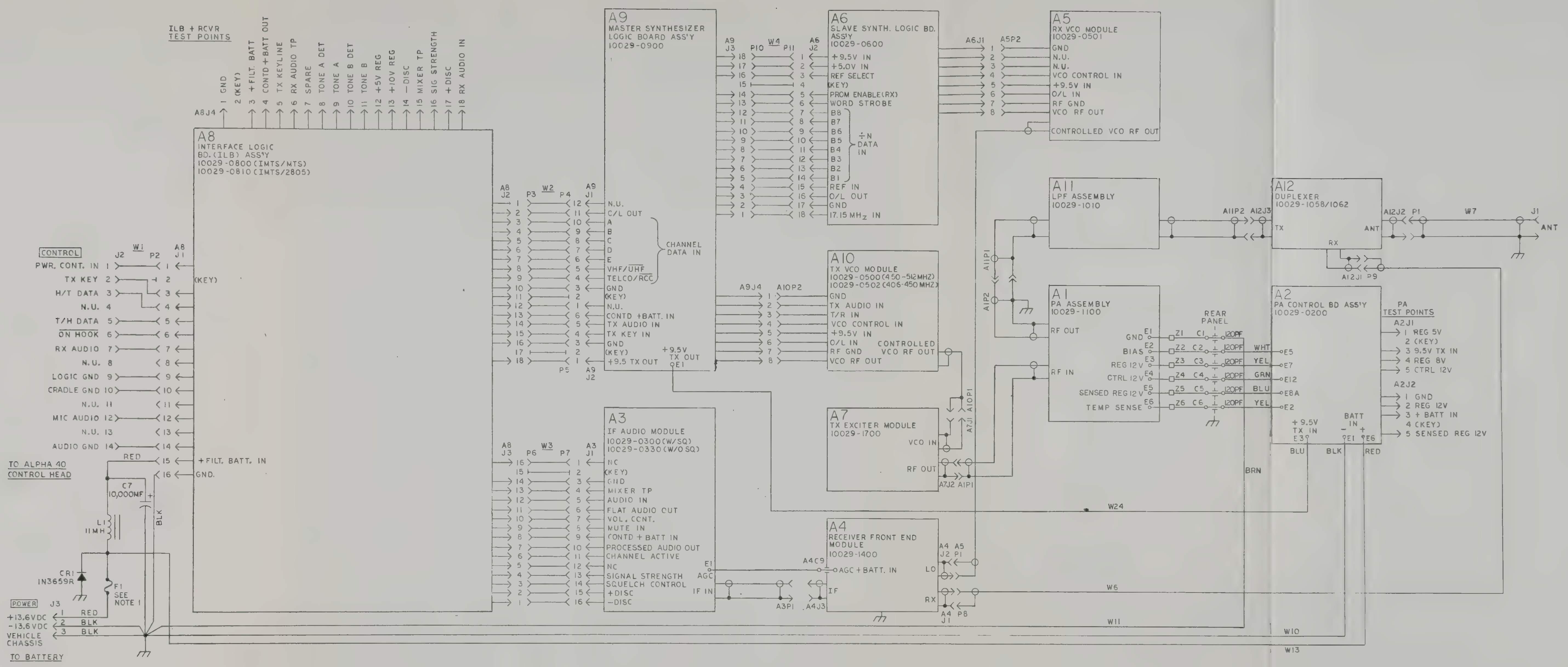
TABLE 3

UHF Transceiver, Parts List

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
Ref	UHF TRANSCEIVER	10029-1000
A	Chassis	10029-0050
A1	PA Module, 450-512 MHz	10029-1100
A2	PA Control Module	10029-0200
A3	IF/Audio Module with Squelch	10029-0300
A3	IF/Audio Module without Squelch	10029-0330
A4	Receiver Front End Module	10029-1400
A5	Receiver VCO Module	10029-0501
A6	Slave Synthesizer Logic Module	10029-0600
A7	Transmit Exciter Module	10029-1700
A8	Interface Logic Module, IMTS/MTS	10029-0800
A8	Interface Logic Module, IMTS/2805	10029-0810
A9	Master Synthesizer Logic Module (4.5 PPM)	10029-0900
A9	Master Synthesizer Logic Module (2 PPM)	10029-0920
A10	Transmit VCO Module (High)	10029-0500
A10	Transmit VCO Module (Low)	10029-0502
A11	Low-Pass Filter Module	10029-1010
A12	Duplexer, RCC	10029-1058
A12	Duplexer, TELCO	10029-1059
A12	Duplexer, 470-490/5 MHz	10029-1061
A12	Duplexer, 490-512/5 MHz	10029-1062



UHF Transceiver Main Frame, Schematic Diagram



NOTES

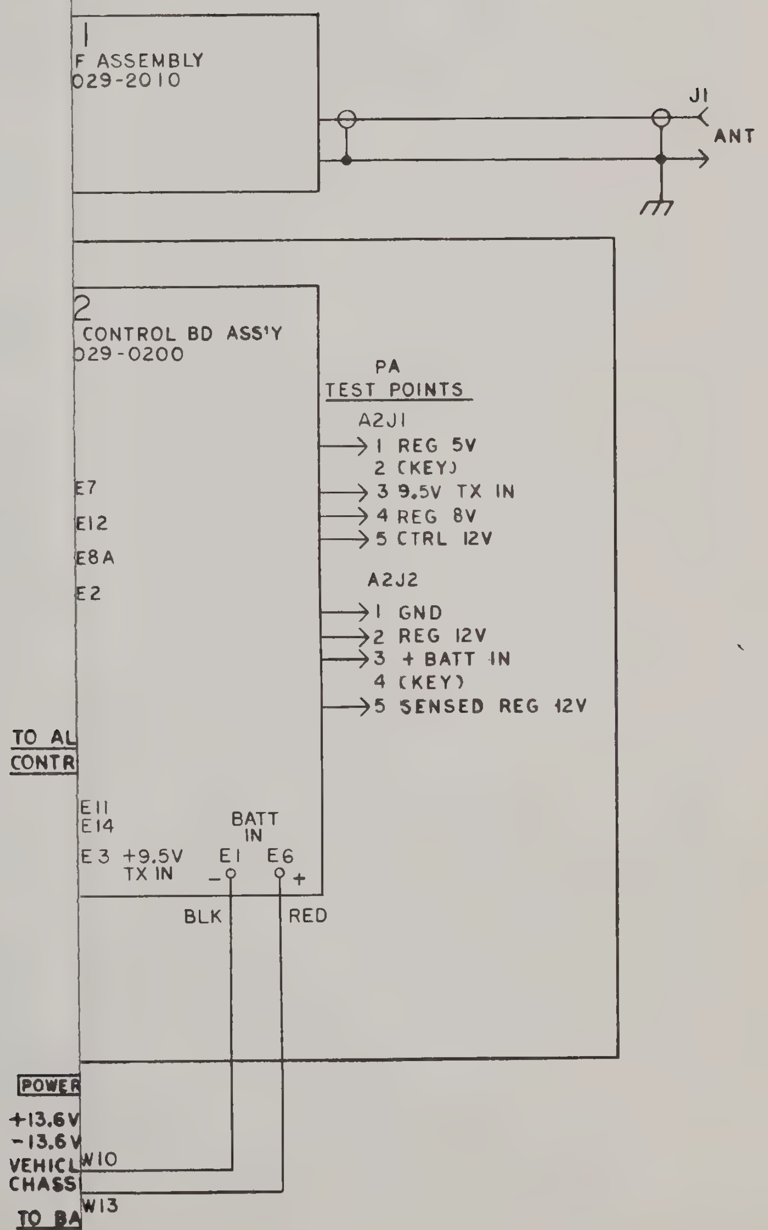
1. FUSIBLE LINK F1, RF PART # 10029-0082, MAY BE REPLACED WITH 1.0 INCH # 28 AWG SOFT DRAWN COPPER WIRE.

Figure 3. UHF Transceiver Main Frame, Schematic Diagram

TABLE 4

VHF Transceiver, Parts List

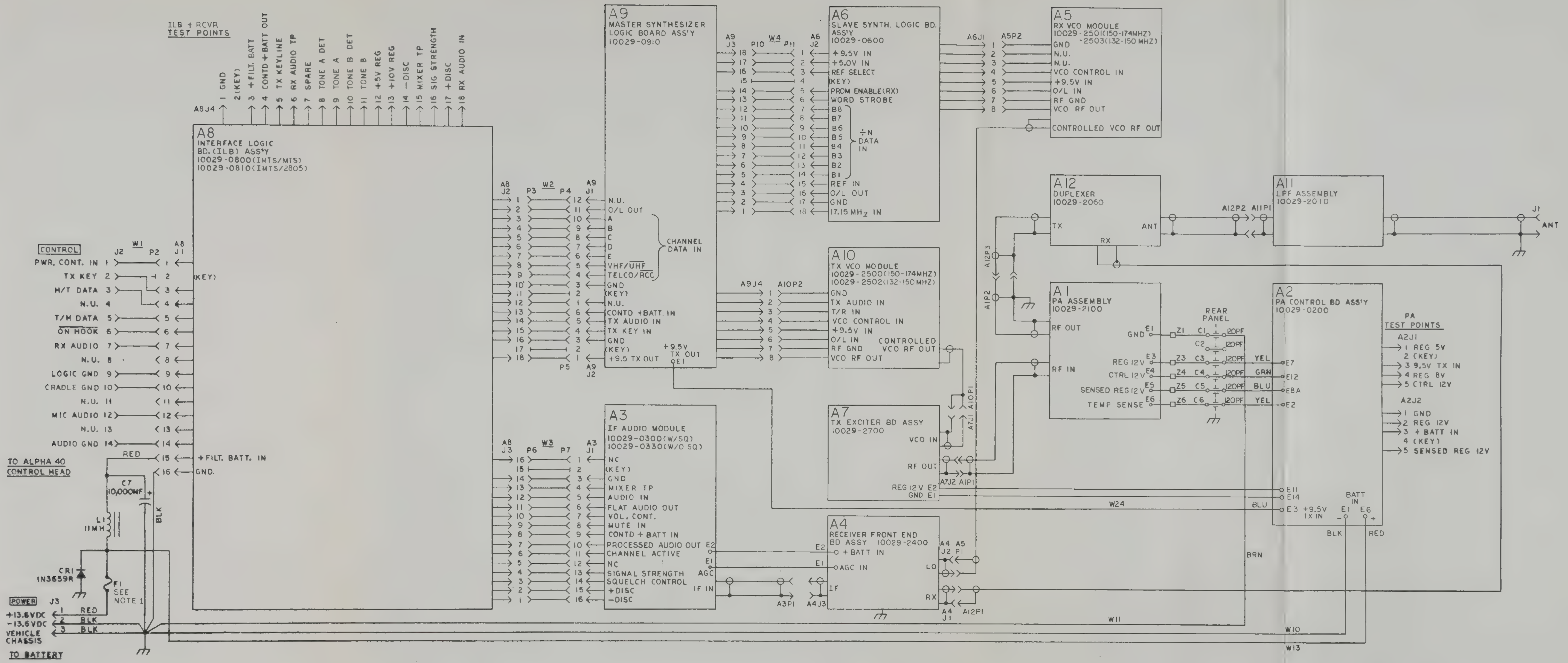
REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
Ref	VHF TRANSCEIVER	10029-2000
A	Chassis	10029-0050
A1	PA Module	10029-2100
A2	PA Control Module	10029-0200
A3	IF/Audio Module, with Squelch	10029-0300
A3	IF/Audio Module, without Squelch	10029-0330
A4	Receiver Front End Module	10029-2400
A5	Receiver VCO Module (High)	10029-2501
A5	Receiver VCO Module (Low)	10029-2503
A6	Slave Synthesizer Logic Module	10029-0600
A7	VHF Exciter Module	10029-2700
A8	Interface Logic Module, IMTS/MTS	10029-0800
A8	Interface Logic Module, IMTS/2805	10029-0810
A9	Master Synthesizer Logic Module (4.5 PPM)	10029-0910
A9	Master Synthesizer Logic Module (2 PPM)	10029-0930
A10	Transmit VCO Module (High)	10029-2500
A10	Transmit VCO Module (Low)	10029-2502
A11	Low-Pass Filter Module (Includes J1)	10020-2010
A12	Duplexer	10029-2060



NOTES

1. FUSIBLE LINK F1, HRF P
MAY BE REPLACED WITH
SOFT DRAWN COPPER WI

VHF Transceiver Main Frame, Schematic Diagram



NOTES

1. FUSIBLE LINK F1, HRF PART # 10029-0082 MAY BE REPLACED WITH 1.0 INCH # 28 AWG SOFT DRAWN COPPER WIRE.

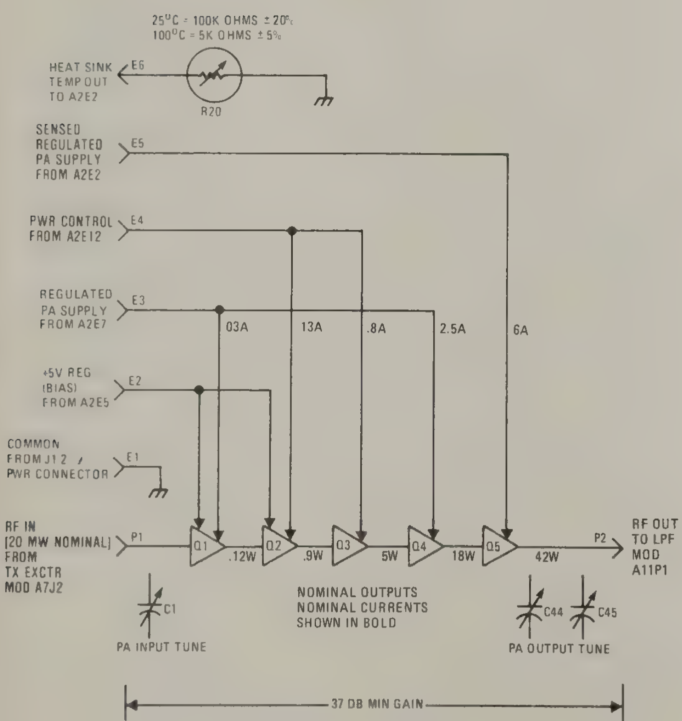
Figure 4. VHF Transceiver Main Frame, Schematic Diagram

A1

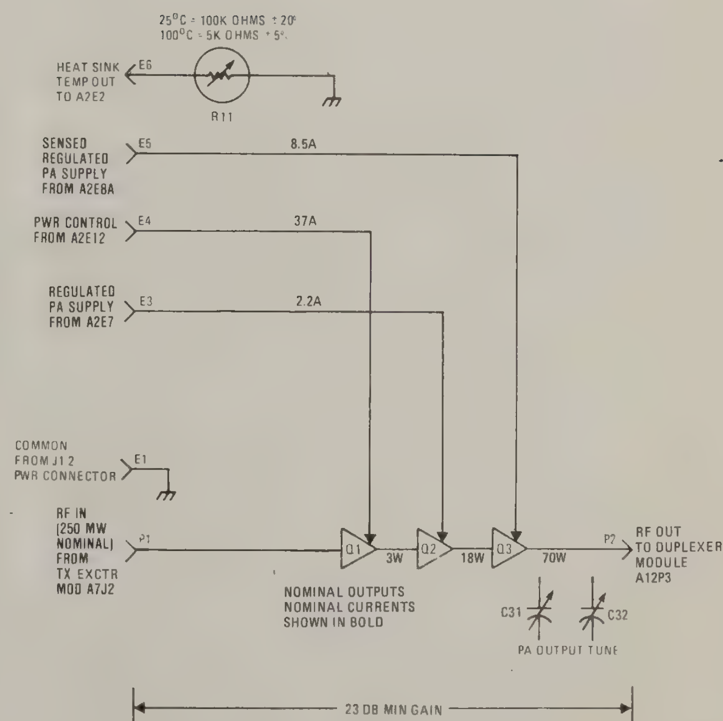
PA MOD

VHF (132–150.8 MHz): 10029-2130
VHF (150.8–174 MHz): 10029-2100

UHF (406–470 MHz): 10029-1130
UHF (450–512 MHz): 10029-1100



UHF
406-470 MHZ
450-512 MHZ



VHF
132 150.8 MHZ
150.8-174 MHZ

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1. GENERAL DESCRIPTION

1.01 The major UHF/VHF PA Control Module A2 functions are shown on the tab cover diagram. The PA Control Module functions as part of the total Transceiver, and provides all the fixed and adjustable regulated voltages required by PA Module A1. Circuits for temperature and current limiting of the PA Module are also part of this assembly. The same assembly is used in both the UHF and VHF Transceivers.

1.02 The PA Control Module is mounted in a shielded compartment on the chassis. This assembly has three adjustments which are used during the Transmitter alignment procedure described in Chapter 4, Maintenance, of this manual.

1.03 The PA Control Module receives +9.5V from Master Synthesizer Logic Module A9 and develops +5V Regulated Bias for the PA Module as well as the regulated +8V used within the PA Control Module as a reference voltage.

1.04 The PA Control Module receives +13.6V (+BATT) through fusible link F1 and a resistance input representative of the PA Module heat sink temperature. These signals and voltages, along with an internally generated PA output stage current sense, are used to develop regulated voltages. These voltages power, control and protect the PA Module.

2. INTERFACE CONNECTIONS

A. UHF PA Control Module Interface Connections

2.01 Table 1 summarizes all UHF PA Control Module interface functions and gives significant TO/FROM information.

B. VHF PA Control Module Interface Connections

2.02 Table 2 summarizes all VHF PA Control Module interface functions and gives significant TO/FROM information.

TABLE 1

UHF PA Control Module Interface Summary

REF DESIG	FUNCTION	TO/FROM	TEST POINTS
E1	Common (GND)	Chassis GND	J2-1
E2	Heat Sink Temp	A1E6	—
E3	+9.5V TX In	A9E1	J1-3
E4	+9.5V TX In	—	—
E5	+5V Reg	A1E2	J1-1
E6	+Batt In (+13.6V)	F1	J2-3
E7	PA Supply	A1E3	J2-2
E8	Sensed PA Supply	A1E5	J2-5
E9	N/A	N/A	—
E10	N/A	N/A	—
E11	Regulated PA Supply	—	—
E12	Power Control	A1E4	J1-5
E13	Power Control	—	—
E14	Common (GND)	—	—

TABLE 2

VHF PA Control Module Interface Summary

REF DESIG	FUNCTION	TO/FROM	TEST POINTS
E1	Common (GND)	Chassis GND	J2-1
E2	Heat Sink Temp	A1E6	—
E3	+9.5V TX In	A9E1	J1-3
E4	+9.5V TX In	—	—
E5	+5V Reg	Not Used	—
E6	+Batt In (+13.6V)	F1	J2-3
E7	PA Supply	A1E3	J2-2
E8	Sensed PA Supply	A1E5	J2-5
E9	N/A	N/A	—
E10	N/A	N/A	—
E11	Regulated PA Supply	A7E2	—
E12	Power Control	A1E4	J1-5
E13	Power Control	—	—
E14	Common (GND)	A7E1	—

3. SUPPLEMENTARY SEMICONDUCTOR DATA

3.01 Supplementary semiconductor data for the UHF/VHF PA Control Module is located in the Chapter 4, Maintenance, Section. It includes the following complex devices listed in table 3.

TABLE 3

UHF/VHF PA Control Moduel Complex Semiconductor Devices

REF DESIG	DEVICE TYPE	FUNCTION
U1	MC78LO8ACP	8 Volt Regulator
U2	LM240LAZ5.0	5 Volt Regulator

4. TECHNICAL DESCRIPTION

A. UHF/VHF PA Control Module Description

4.01 The +9.5V Tx stable reference voltage, derived from the Keyline signal in the Master Synthesizer Logic Module, is applied through E2 on the board to input (pin 1) of +8 Volt Regulator U1, and input (pin 1) of +5 Volt Regulator U2.

4.02 The +5V REG output (pin 2) of U2 is applied to amplifiers Q1 and Q2 on the UHF PA Module as +5 V Reg (Bias) voltage. The +5V REG may be monitored on the PA Control Module at test jack J1-1.

4.03 The +8V Reg output (pin 2) of U1 is used on the PA Control Module as a stable reference, and may be monitored on the PA Control Module at test jack J1-4.

4.04 Transistors Q8 and Q9 compare the +12 V Reg output to the voltage derived from the +8V Reg stable reference voltage. The output of this comparison circuit is used to drive pass elements Q12 and Q13 via driver transistor Q14. Potentiometer R33 (PA Supply Adjust) allows the regulator output to be adjusted over a range of several volts. A separate voltage (Sensed PA Supply) is provided to the PA output stage through current sampling resistors R45 through R49.

4.05 The power Control Regulator Comparison transistors Q4 and Q5, in conjunction with pass element Q15, function in a similar manner to transistors Q8, Q9, Q12, Q13, Q14. Power Control Level Adjust potentiometer R23 has a sufficient adjustment range to provide an adjustable output level for the Transceiver (15 to 30 watts for UHF and 25 to 50 watts for VHF).

4.06 Transistors Q6 and Q7 compare the voltage (proportional to PA output stage current) developed across R45 through R49 with an adjustable reference (controlled by R23) set during the alignment procedure.

4.07 PA Module thermistor A1R20 in conjuction with PA Control Module resistors R1 and R2, provide a voltage proportional to the PA Module temperature. Transistors Q1 and Q2 compare this voltage with a fixed voltage derived from the regulated eight volt transmit reference.

4.08 Both the Current Limiter circuit and the Thermal Limiting circuit control the output of the Power Control Regulator. Whenever excessive temperatures and/or currents occur, outputs from the limiter circuits cause Q3 to conduct while reducing the regulator output.

4.09 The output of the PA Module is controlled by adjusting the output voltage of the Power Control Regulator which supplies the second and third stages of UHF PA Control Module and the first stage of VHF PA Control Module. To ensure maximum efficiency, the PA output stage adjustments are fine tuned at each new power output setting. Refer to PA Module alignment in the PA Module tab section for more detail.

5. MAINTENANCE

A. General Information

5.01 All significant signal and control inputs and outputs are shown on the tab cover diagram and schematic diagram in this tab section, and in the PA Module tab section. The adjustments indicated by the alignment procedures described in these paragraphs are made at the factory prior to shipment. Normally, it should not be necessary to repeat any of these adjustments unless there are component failures or readjustment becomes necessary for some specific reason. The PA Control Module adjustments

(2) Heat the terminals of the base and collector capacitors, and carefully lift them from the PA Module board with a small knife. Use a solder wick or otherwise remove any solder between the board and the capacitor terminals.

(3) For the larger (0.4-inch) capacitor, used in the VHF PA Module, heat capacitor body until solder flows and remove capacitor from board. This is done by lifting it with a small pair of needle-nose pliers clamped onto the previously unsoldered terminal.

(4) With the smaller capacitor used on the UHF PA Module, first cut mounting tabs (two) at rear of part, then proceed to lift terminal. After this is done lift case as with larger capacitors. Because of high probability of damage and degradation resulting from flux entering the capacitor, it is strongly recommended that new capacitors be installed.

(5) Next heat and lift with a knife, all six leads of transistor. Be certain that solder is soft before prying with a knife. Avoid excess heat, which may cause lifting of a trace from board.

(6) Using solder wick, remove solder from crevice between board trace and lead. Carefully remove solder to ensure easy part removal and to reduce risk of board trace damage.

(7) Unfasten transistor mounting screws, and gently lift transistor out of its hole. If part is not free at this point, determine which lead is still attached and heat it while gently lifting part.

(8) For the 0.2-inch square capacitor in the UHF PA Module, carefully heat the printed circuit board foil surrounding the previously cut capacitor tabs. Use a pair of needle-nose pliers, and carefully pull tab out of the plated-through mounting hole. If hole was not soldered, it may be possible to pull tab out without using heat. If tab cannot be pulled out, try pushing tab through to bottom of board. If all this fails, cut tab flush with top of board, and remove corresponding tab on new part.

(9) Discard transistor and its associated capacitor. If for any reason part is to be reused, straighten its leads and remove all solder lumps from the underside of leads and case of part. Remove all thermal grease on base of flange. Inspect flange for flatness, by holding flange against a straight edge and looking for light between flange and straight edge. See Figure 2 for Power Amplifier component replacement information.

(10) The transistor flange surface should be flat to slightly convex, but never concave. If part appears to be concave, insert two 0.125-inch diameter drills into mounting holes and gently squeeze with thumb and forefinger until flange is flat or slightly convex.

(11) When using a new part, tin underside of all leads. Make sure there are no solder lumps. It is recommended that flange be checked for flatness following tinning procedure. Use a solvent to clean surface of heat sink until it is free of all thermal grease and foreign matter. Next apply a thin uniform coating of thermal grease (DOW CORNING 340 is required) to underside of flange. Be sure flange edge is free of grease.

(12) The board traces must be free of all grease, flux, and solder lumps.

(13) Place transistor on board/heat sink assembly and push down on transistor until it makes contact with heat sink. Note transistor orientation. Rotate transistor back-and-forth through approximately 10° while pushing down on the ceramic top cap to work grease into heat sink and flange. While keeping transistor base and collector leads centered over stripline traces, install transistor mounting screws and alternately tighten them lightly. Torque screws to six inch-pounds.

(14) Solder all leads of transistor to board foil. Hold each lead down with a knife while the solder cools. Avoid solder lumps. Avoid getting solder in small capacitor mounting tab holes.

(15) When using a new part, it is necessary to remove the epoxy flash on base and collector leads. Epoxy is left over from putting caps on transistor. Using a small knife, remove this flash after soldering down part.

(16) After flash removal, install base and collector capacitors in holes provided, Heat top of capacitor with a soldering iron and push down at same time while feeding solder in along both sides of part. (Never feed solder in from the front or back.) When properly installed a thin line of solder will be visible at junction of case and circuit board foil on sides of capacitor. Keep center lead of capacitors as close to transistor as possible and hold capacitor down with a knife while solder cools.

CAUTION

Use minimum time necessary with the soldering iron and do not run solder in the front or back of the capacitor.

(17) Solder center tabs of capacitors holding them in place until solder cools (use a minimum of heat). Avoid excess solder. Do not use separate flux or a solder with a highly activated flux. Cleaning at this point is not recommended since most cleaning solvents will attack thermal grease and carry flux into capacitor.

(18) On the VHF PA Module install large (0.4-inch square) capacitors as close to transistor as possible.

(b) Stud mount transistors (VHF Q1 and Q2 and UHF Q3).

(1) Follow instructions in part 5.01B (a) for removal of transistors and associated capacitors.

(2) After tinning leads and applying thermal grease, push stud down through hole in heat sink. (On the UHF PA Module do not forget the Q3 spacer.) Loosely screw on nut. Position transistor correctly over base and collector traces. While holding transistor in this position, lightly tighten nut.

(3) Apply a small amount of solder to two emitter leads (ground) to hold part in place. Now, torque transistor nut to six-inch pounds. Solder all leads. Avoid solder lumps. Hold leads down with a small knife until solder cools. Install capacitors as described before. Put a small amount of either Glyptol or Locktite over nut and stud (use sparingly) to keep nut from turning due to vibration.

(c) Studless Transistor (UHF Q2)

(1) Follow procedure described for Stud Mount Transistor except for portion relating to stud.

(d) TO 43 Transistor (UHF Q1)

(1) The board must be removed from the heat sink to replace this part. Use a vacuum device or a solder braid to completely clear plated-through holes. Keep greased surfaces free of all foreign matter.

(2) When installing new part, be sure to use transistor pad. Seat part until pad contacts bypass capacitor C4.

(3) Before reinstalling the board onto heat sink, use a pair of drills to gently bend mounting ear of flange on the UHF transistors Q4 and Q5. See procedure under (a) for more information. Reinstall insulating paper and finger stock in same order as they were removed. Loosely reinstall all hardware. Retorque all transistor hardware starting with highest Q number and working backwards. (Be sure that Q3 spacer is in place). When retightening hardware, be certain that paper insulator is not trapped between a transistor or board mounting spacer and heat sink. Reapply Glyptol or Loctite to Q3 nut (see 19(b)3).

(4) After all screws are secured pull insulator with a pair of needle-nose pliers and make sure that it can be moved. It should be moveable with moderate force.

C. Fault Isolation

UHF PA Module

5.02 The Q1/Q2 interface at the C11/C12 junction, the Q2/Q3 interface at capacitor C15, the Q4/Q5 interface at capacitor C37, and the PA input and output all have 50 ohm impedances. These points may be checked using an appropriate rf wattmeter and load for the proper power measurement. The interface power levels may be checked by breaking the circuit at the blocking capacitors (C11, C15, or C37) and inserting a directional wattmeter between the stages. When performing this check, be sure to keep the dc blocking capacitors (C11, C15, or C37) on the input side of the wattmeter. Whenever attaching a coaxial cable to an rf circuit without a connector, make the ground and center conductor as short as possible. Use a small flexible cable such as RG 316. Keep the

cable between the circuit and the wattmeter as short as possible. The forward power indication should be within, or close to, the range indicated on the tab cover diagram. The reflected power indications from the stage following the wattmeter should be less than 13% of the forward power observed. When reconnecting the stage, use a new chip capacitor and solder in place using a small 700°F soldering iron. Use a minimum amount of heat.

5.03 The collector currents may also be used to help isolate a fault to a particular stage. The technique is simple to use, and in conjunction with the rf power measurements, should successfully locate a faulty stage. Before proceeding, ensure that all dc voltages are correct. Consider the following example.

(a) If rf power output of Transceiver is low or nonexistent, the first step would be to examine the PA Module output power.

(b) A UHF PA Module output power level of approximately 42 watts would indicate a problem in Low-Pass Filter Module or in the Duplexer.

(c) If the PA Module power is substandard, first check PA Module drive from Exciter Module. Assuming for this example, proper Module input drive signal, check each stage of PA Module starting with Q1.

(d) Assume for this example that Q2 and Q3 currents are abnormal. Tip up capacitor C15 so that it rests on end at output trace of Q2. Attach a wattmeter and load from isolated side of C15 to ground. Observe power and stage current. Normal power and current in this example indicates a problem in the following stage.

(e) At this point a wattmeter should be inserted between stages. A high reflected power indication from stage three would confirm a fault location and could also indicate a defect in the input circuit of that stage.

(f) Normal stage two current and low stage three current, coupled with a reasonable stage three reflected power, would tend to indicate a problem in the output circuit of stage three.

5.04 The approximate UHF PA Module stage currents and power levels are shown on the tab section front cover diagram. Remember when troubleshooting PA Module, that many factors such as frequency, device gain, and Transceiver power output, can affect interstage power and stage current. Only approximate power and current ranges are given for full rated output.

VHF PA Module

5.05 Fault isolation techniques of 5.02 and 5.03 apply to the VHF PA Module with one exception. The VHF PA Module interstage impedances are not 50 ohms and these points may not be readily checked for proper rf power levels. The VHF PA Module input and output points here 50 ohm impedances.

D. UHF PA Module Alignment

5.06 Figures 1 and 3 give related support information.

(a) Complete alignment for TX VCO Module TX Exciter Module, and PA Control Module.

(b) Set power supply output to +13.6 Vdc +2.7, −0 Vdc and ensure that it is within this range during this procedure.

(c) Rotate trimmer C1 (Input Tune) and trimmer C44 and C45 (Output Tune) to midrange (i.e., 1½ turns from tight, for a mica capacitor and ½ turn for an air capacitor).

(d) Rotate potentiometer A2R23 (PA Current Limit Adjust) and potentiometer A2R19 (Drive Control Level Adjust) to extreme CCW position.

(e) Key Transmitter and adjust A2R33 (PA Supply Adjust) for +12.5 Vdc between test points A2TP1 and A2J2-2. Unkey Transmitter. Adjust A2R23 extreme CW.

(f) Key Transmitter and adjust C1, C44 and C45 for maximum wattmeter indication. Repeat adjustment several times until power indication stabilizes.

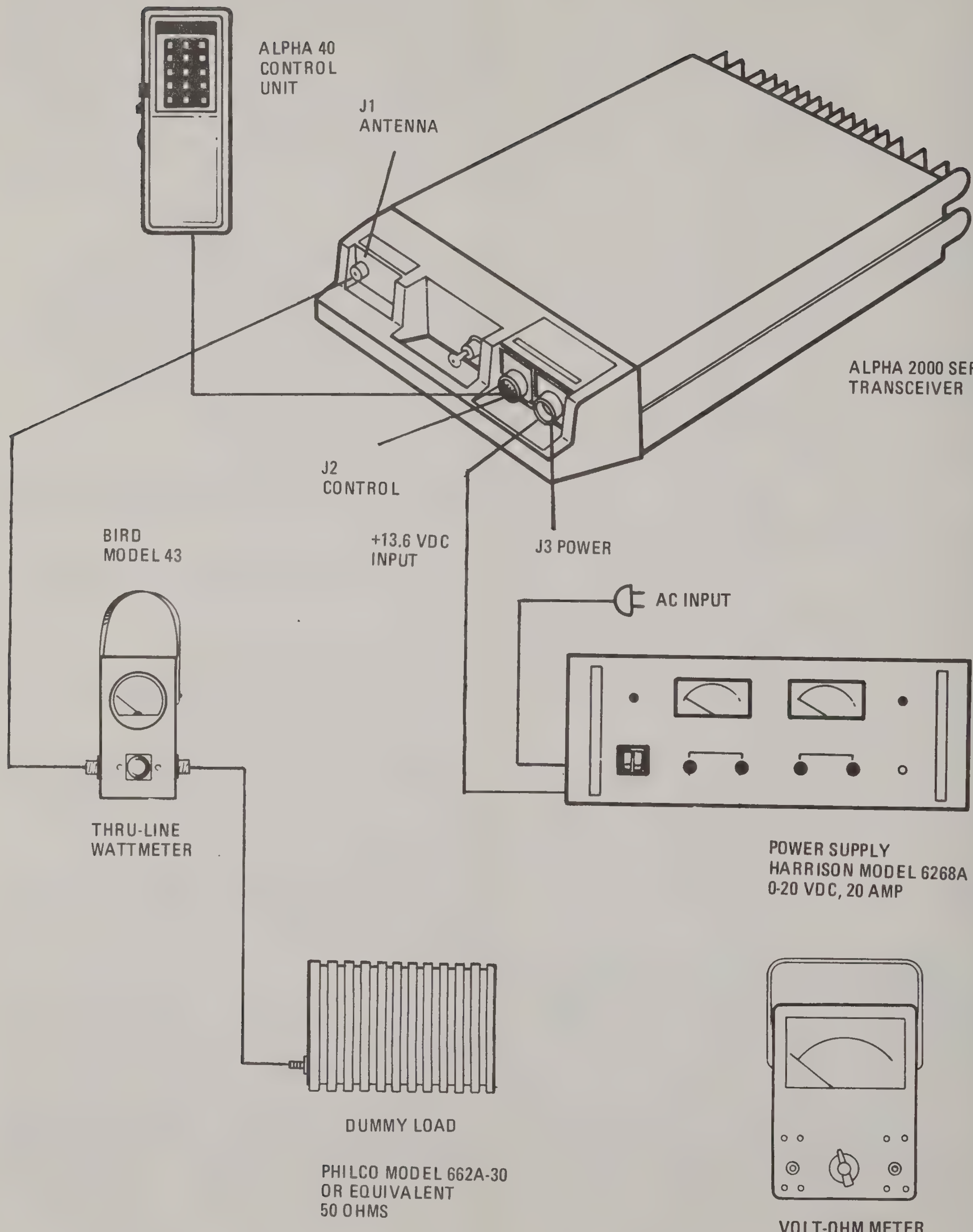


Figure 1. UHF/VHF PA Module, Test Setup

(g) Key Transmitter and adjust potentiometer A2R19 (Power Control) for an output of 15 to 30 watts. Adjust C44 and C45 for maximum output.

(h) Repeat step (g) until power output is within plus or minus 5% of desired output.

(i) Key Transmitter and adjust A2R23 CCW until power output just begins to decrease.

(j) If PA Module has been previously aligned and it is necessary to change power output, rotate A2R23 fully CW and proceed to step (h).

E. VHF PA Module Alignment

5.07 The VHF PA Module may be aligned following same procedure used for UHF PA Module. Note that in steps (c) and (f) there are no input stage adjustments and the output capacitors are C31 and C32. In step (g) the power range is 25 to 50 watts.

F. UHF/VHF PA Module Thermal Cut Back Check

(a) To check the operation of the UHF/VHF PA Module thermal cut back circuit, connect dc voltmeter to A2J1-5 (+) and A2TP1 (−) on PA Control Module.

(b) Key Transmitter and place 3.9K ohm resistor from A2E2 to ground.

(c) Voltage on A2J1-5 should decrease. If not, there is a problem in thermal cut back circuitry or thermistor in the PA Module may be defective. Refer to tab cover of this section for thermistor data.

6. PARTS LIST

A. UHF PA Module Parts List

6.01 The UHF PA Module parts list information is given in table 3. Figure 3 gives the UHF PA Module component location information.

B. VHF PA Module Parts List

6.02 The VHF Module parts list information is given in table 4. Figure 5 gives the VHF PA Module component location information.

7. SCHEMATIC DIAGRAMS

A. UHF PA Module Schematic Diagram

7.01 Figure 4 is the UHF PA Module schematic diagram.

B. VHF PA Module Schematic Diagram

7.02 Figure 6 is the VHF PA Module schematic diagram.

TABLE 3

UHF PA Module, Parts List

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
A1	PA MOD A1	10029-1100
C1	Capacitor, Variable, 1.9–15.7 pF	C-1186
C2	Capacitor, Ceramic, 0.1 μF, 50V	C-3202
C3	Capacitor, UNELCO, 15 pF	C45-0001-150
C4	Capacitor, Ceramic Monolithic, 100 pF, 50V	C-0200
C5	Capacitor, Tantalum, 1 μF, 35V	C-3100
C6	Capacitor, UNELCO, 150 pF	C45-0001-151
C7	Capacitor, Tantalum, 1 μF, 35 V	C-3100
C8	Capacitor, Ceramic, 100 pF	C-6830
C9	Capacitor, UNELCO, 150 pF	C45-0001-151
C10	Capacitor, UNELCO, 12 pF	C45-0001-120
C11	Capacitor, Ceramic, 3 pF	C-4733
C12	Capacitor, UNELCO, 33 pF	C45-0001-330
C13	Capacitor, UNELCO, 22 pF	C45-0001-220
C14	Capacitor, UNELCO, 22 pF	C45-0001-220
C15	Capacitor, Ceramic Monolithic, 100pF, 50V	C-0200
C16	Capacitor, Tantalum, 1 μF, 35 V	C-3100
C17	Capacitor, UNELCO, 150 pF	C45-0001-151
C18	Capacitor, Ceramic, 3.9 pF, 1000V	C-4735
C19	Capacitor, UNELCO, 10 pF	C45-0001-100
C20	Capacitor, UNELCO, 43 pF	C45-0001-430
C21	Capacitor, UNELCO, 39 pF	C45-0001-390
C22	Capacitor, Tantalum, 1 μF, 35 V	C-3100
C23	Capacitor, UNELCO, 150 pF	C45-0001-151

TABLE 3

UHF PA Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
C24	Capacitor, UNELCO, 18 pF	C45-0001-180
C25	Capacitor, Ceramic Monolithic, 100 pF, 50V	C-0200
C26	Capacitor, UNELCO, 8.2 pF	C45-0001-829
C27	Capacitor, UNELCO, 27 pF	C45-0001-270
C28	Capcitor, UNELCO, 30 pF	C45-0001-300
C29	Capacitor, UNELCO, 33 pF	C45-0001-330
C30	Capacitor, UNELCO, 33 pF	C45-0001-330
C31	Capacitor, UNELCO, 13 pF	C45-0001-130
C32	Capacitor, UNELCO, 6.8 pF	C45-0001-689
C33	Capacitor, Tantalum, 1 μF, 35V	C-3100
C34	Capacitor, Ceramic, 0.0047 μF, 50V	C11-0005-472
C35	Capacitor, UNELCO, 150 pF	C45-0001-151
C36	Capacitor, UNELCO, 5.6 pF	C45-0001-569
C37	Capacitor, Ceramic, Monolithic, 100 pF, 50V	C-0200
C38	Capacitor, UNELCO, 9.1 pF	C45-0001-919
C39	Capacitor, UNELCO, 30 pF	C45-0001-300
C40	Capacitor, UNELCO, 30 pF	C45-0001-300
C41	Capacitor, UNELCO, 43 pF	C45-0001-430
C42	Capacitor, UNELCO, 43 pF	C45-0001-430
C43	Capacitor, Ceramic, 0.0047 μF, 50V	C11-0005-472
C44	Capacitor, Variable, 12–65pF	C84-0001-004
C45	Capacitor, Variable, 1.9–15.7 pF	C-1186
C46	Capacitor, Ceramic, 0.1 μF	C-3202
C47	Capacitor, UNELCO, 150 pF	C45-0001-151

TABLE 3

UHF PA Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
C48	Capacitor, Tantalum, 1 μF, 35V	C-3100
C49	Capacitor, Ceramic, 0.0047 μF, 50V	C11-0005-472
C50	Capacitor, Ceramic, 0.0047 μF, 50V	C11-0005-472
C51	Capacitor, Ceramic, 0.0047 μF, 50V	C11-0005-472
E1	Terminal, PCB, 0.055 thick	E-1306
E2	Connector Pin	MP-0287
E3	Terminal, PCB, 0.055 thick	E-1306
E4	Connector Pin	MP-0372
E5	Terminal, PCB, 0.055 thick	E-1306
E6	Connector Pin	MP-0287
L1	Inductor	10029-1110
L2	Choke, molded, 0.065 μH	L05-0001-006
L3	Inductor	10029-1111
L4	Choke, molded, 0.018 μH	L05-0001-001
L5	Choke, rf, 1 μH	L-0054
L6	Choke, rf, 1 μH	L-0054
L7	Choke, molded, 0.065 μH	L05-0001-006
L8	Choke, molded, 0.065 μH	L05-0001-006
L9	Choke, rf, 1 μH	L-0054
L10	Choke, molded, 0.065 μH	L05-0001-006
L11	Choke, rf, 1 μH	L-0054
L12	Choke, molded, 0.018 μH	L05-0001-001
L13	Choke, molded, 0.137 μH	L05-0001-011
L14	Choke, molded, 0.054 μH	L05-0001-005

TABLE 3

UHF PA Module, Parts List (Cont.)

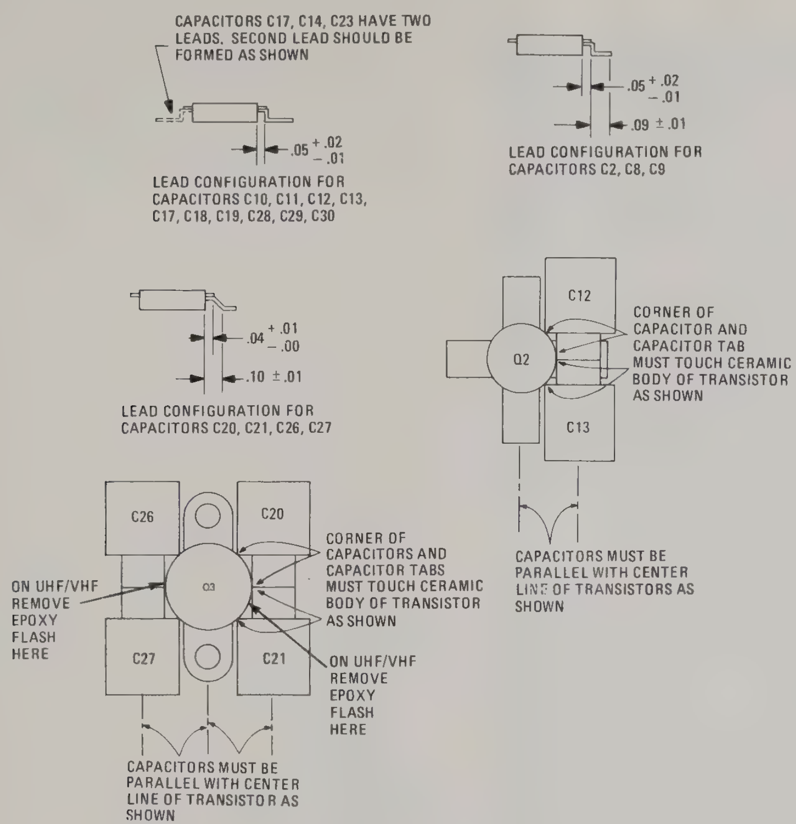
REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
Q1	Transistor, PT 4277A	Q30-0001-000
Q2	Transistor, PT 4277B	Q30-0002-000
Q3	Transistor, PT 4277C	Q30-0003-000
Q4	Transistor, PT 4277D	Q30-0004-000
Q5	Transistor, PT 4277E	Q30-0005-000
R1	Resistor, Composition, 560 ohm ±5%, ¼W	R-1243
R2	Resistor, Composition, 270 ohm ±5%, ¼W	R-1235
R3	Resistor, Composition, 1.8K ohm ±5%, ¼W	R-1255
R4	Resistor, Composition, 27 ohm ±5%, ¼W	R-1211
R5	Resistor, Composition, 100 ohm ±5%, ½W	R-1425
R6	Resistor, Composition, 11 ohm ±5%, ¼W	R-1202
R7	Resistor, Composition, 120 ohm ±5%, ½W	R-1427
R8	Resistor, Composition, 2.7 ohm ±5%, ¼W	R-1354
R9	Resistor, Composition, 2.7 ohm ±5%, ¼W	R-1354
R10	Resistor, Composition, 470 ohm ±5%, ¼W	R-1241
R11	Resistor, Composition, 33 ohm ±5%, ½W	R-1413
R12	Resistor, Composition, 0.47 ohm ±10%, 2W	R-3844
R13	Resistor, Composition, 2.7 ohm ±5%, ¼W	R-1354
R14	Resistor, Composition, 10 ohm ±5%, ½W	R-1401
R15	Resistor, Composition, 1 ohm ±5%, ½W	R-1567
R16	Resistor, Composition, 10 ohm ±5%, ½W	R-1401
R17	Not Used	
R18	Resistor, Composition, 1 ohm ±5%, ½W	R-1567
R19	Resistor, Composition, 22 ohm ±5%, ½W	R-1409

TABLE 3

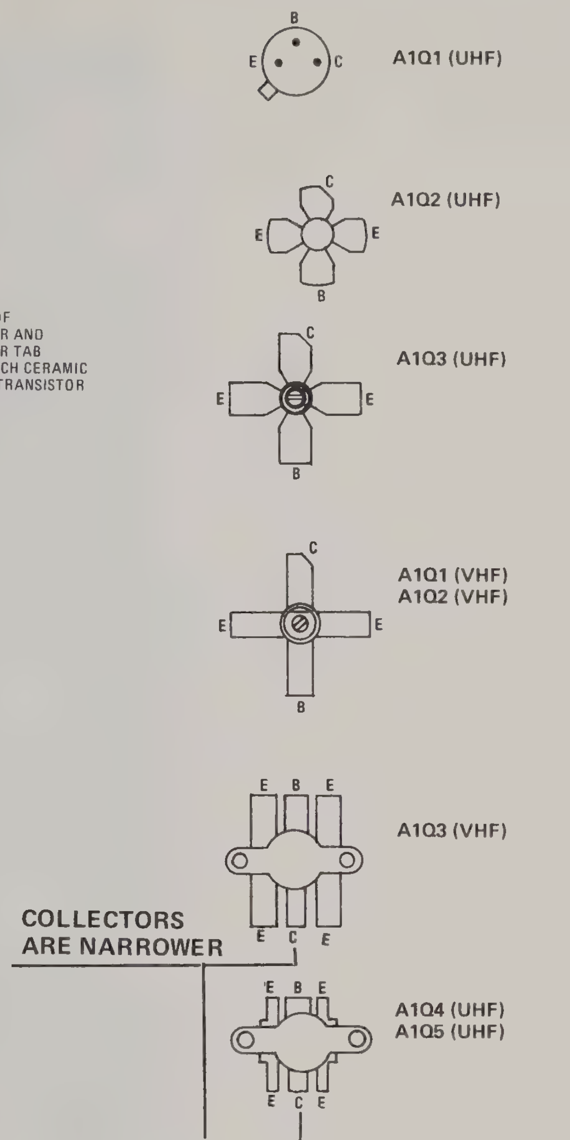
UHF PA Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
R20	Thermistor, 100K ohm	R-7888
R21	Resistor, Composition, 1 ohm ±5%, ½W	R-1567
Z1	Bead, shielding	E-2195
P1	Coax Cable Assy	10029-1115
P2	Coax Cable Assy	10029-1116
	MAJOR MECHANICAL PARTS	
	Contact Strip	10029-1135
	PA PWB to Chassis Insulator	10029-1134
	Screw, PA PWB to Heatsink 4-40 x 1/2	H 5915
	Screw, Heatsink to Chassis 8-32 x 7/8	H 5941
	O-Ring for H 5941 above	MP 4127
	Screw, PA Transistor, 4-40 x 5/16	H 0210

CAPACITOR LEAD PREPARATION AND ORIENTATION FOR VHF PA. CAPACITORS FOR UHF PA HAVE PREFORMED LEADS AND LOCATING LEGS.



PA TRANSISTOR OUTLINES (BOTTOM VIEWS)



CAUTION

Leads on replacement transistor must be trimmed in accordance with the part it replaces.

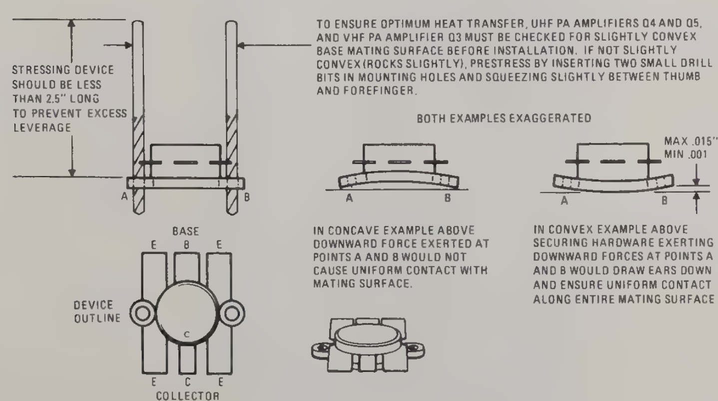
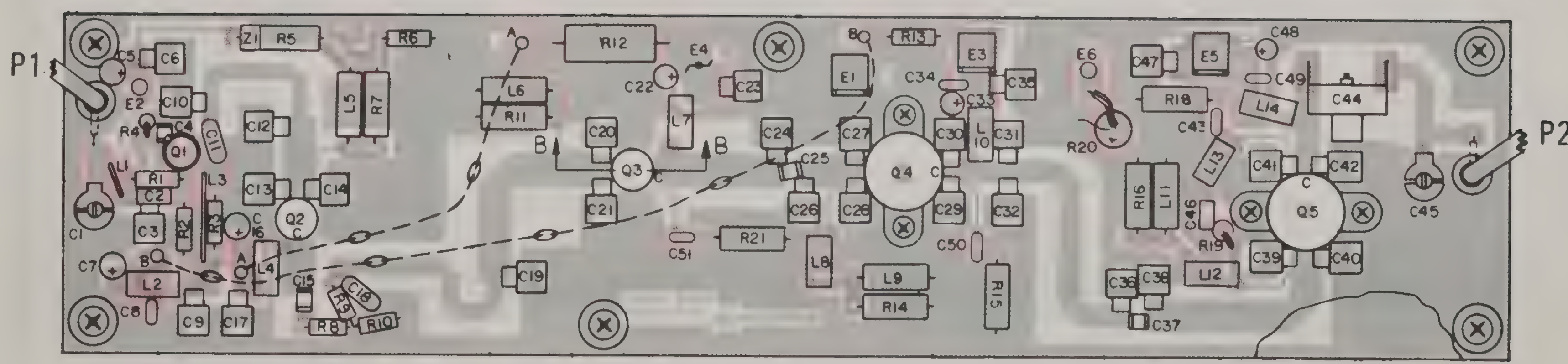


Figure 2. Power Amplifier Component Replacement Information

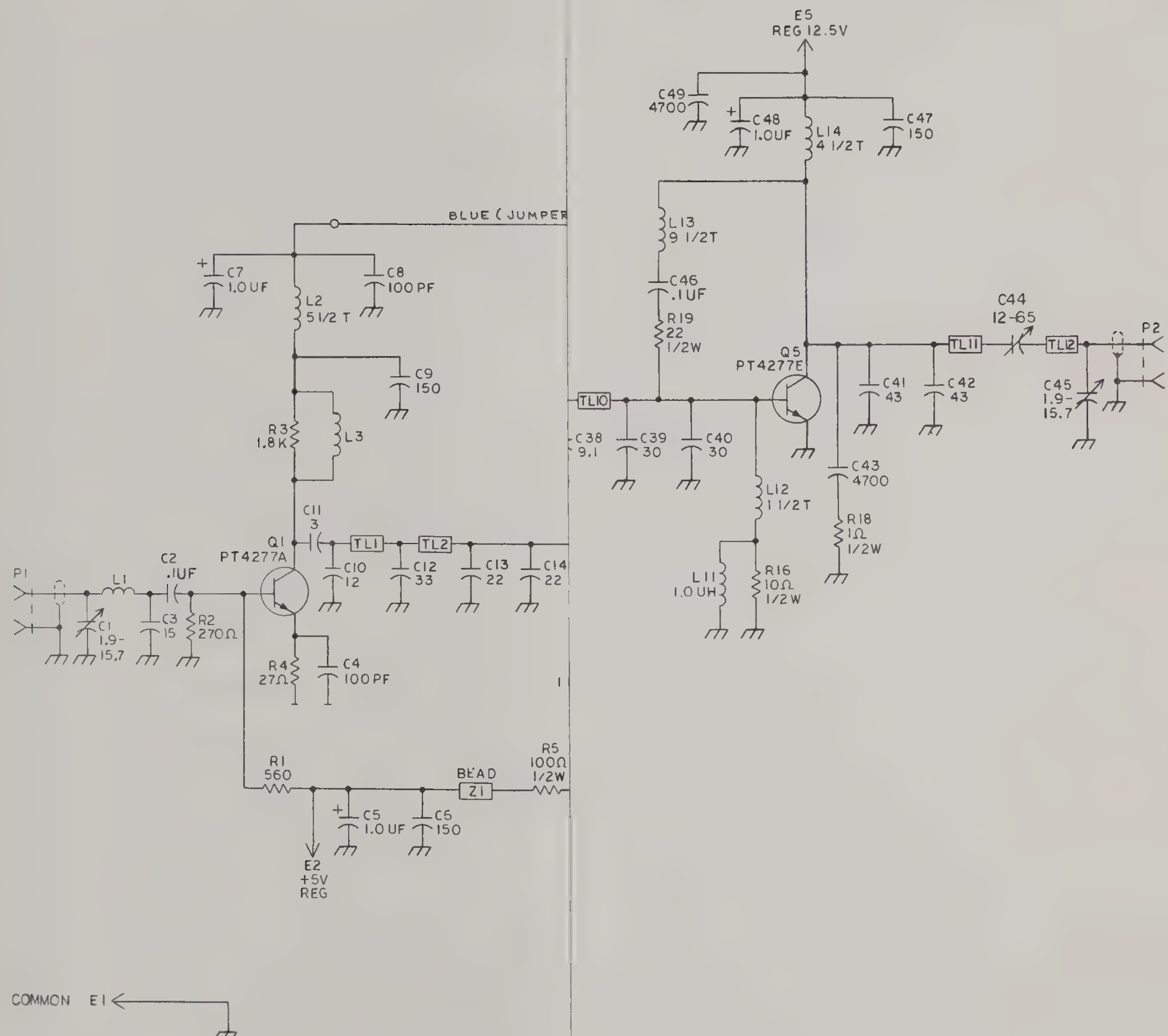


NOTE:
- COMPONENTS SHOWN IN SOLID BLACK
- FACING SIDE FOIL SHOWN IN BLACK SCREEN
- OPPOSITE SIDE FOIL SHOWN IN RED SCREEN

Figure 3. UHF PA Module, Component Location Diagram

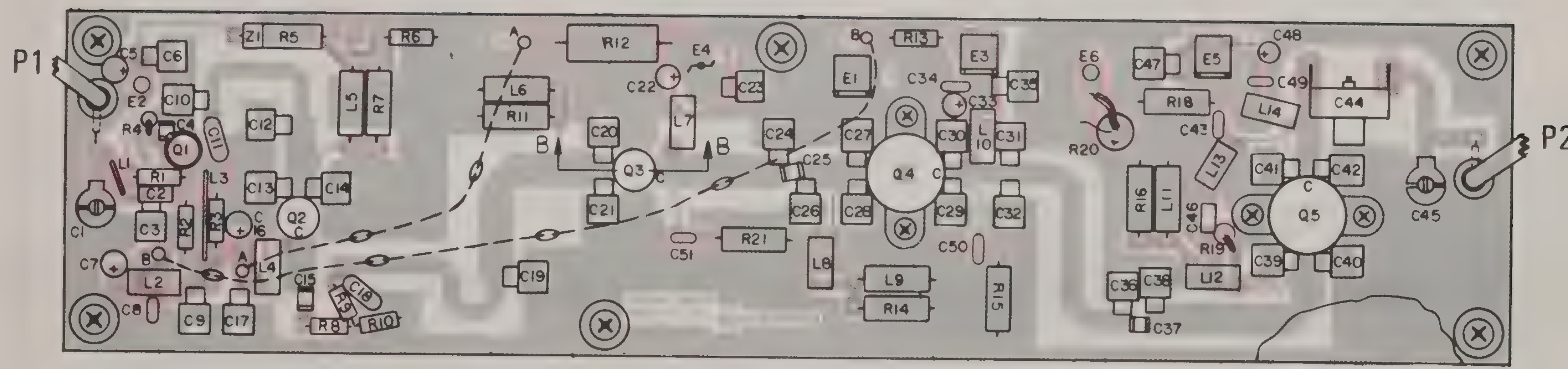
NOTES: UNLESS OTHERWISE SPECIFIED:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER AND/OR ASSEMBLY DESIGNATION.
2. RESISTOR VALUES ARE IN OHMS, 1/4W, 5%
3. CAPACITOR VALUES ARE IN PF.
4. VENDOR AND/OR JEDEC PART NUMBER CALLOUTS ARE FOR REFERENCE ONLY COMPONENTS ARE SUPPLIED PER PART NUMBER IN PARTS LIST.



HIGHEST REFERENCE DESIGNATION					
C51	R21	L14	P2	E6	Q5
TL12					
REFERENCE DESIGNATIONS NOT USED					
R17					

Figure 4. UHF PA Module, Schematic Diagram

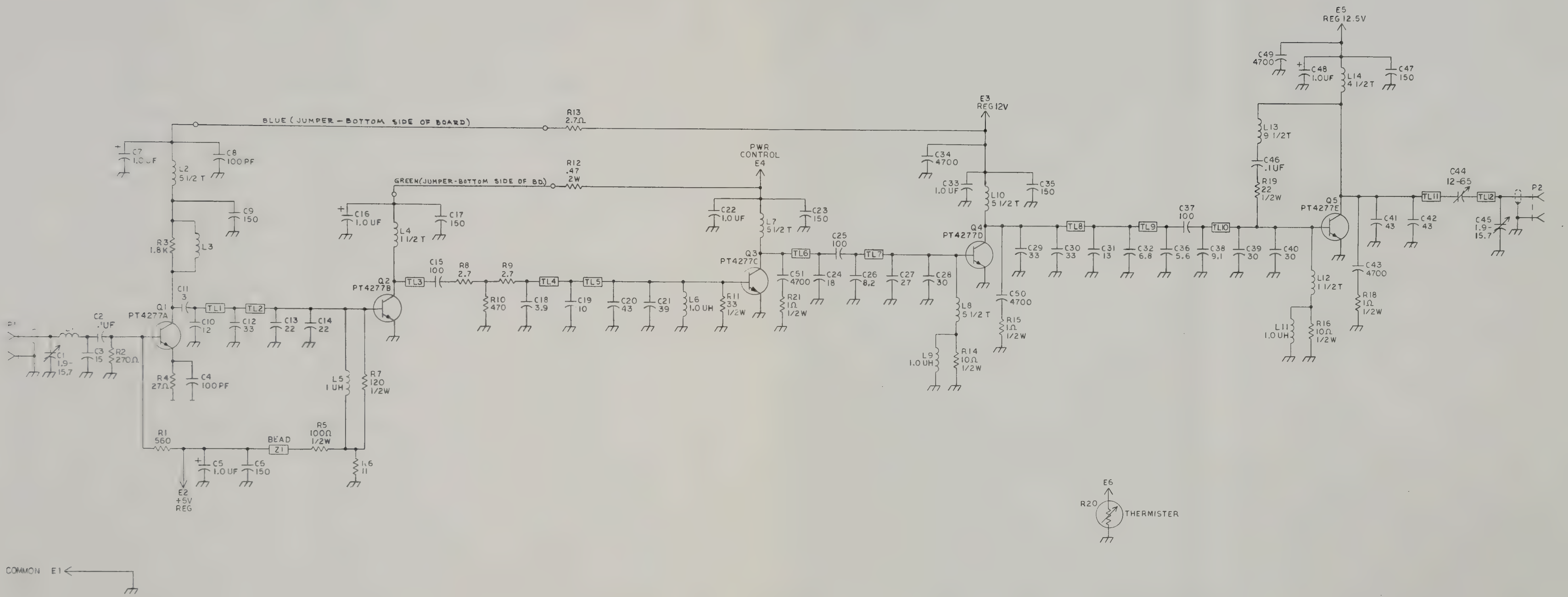


NOTE:
- COMPONENTS SHOWN IN SOLID BLACK
- FACING SIDE FOIL SHOWN IN BLACK SCREEN
- OPPOSITE SIDE FOIL SHOWN IN RED SCREEN

Figure 3. UHF PA Module, Component Location Diagram

NOTES: UNLESS OTHERWISE SPECIFIED:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER AND/OR ASSEMBLY DESIGNATION.
2. RESISTOR VALUES ARE IN OHMS, 1/4W, 5%
3. CAPACITOR VALUES ARE IN PF.
4. VENDOR AND/OR JEDEC PART NUMBER CALLOUTS ARE FOR REFERENCE ONLY COMPONENTS ARE SUPPLIED PER PART NUMBER IN PARTS LIST.



HIGHEST REFERENCE DESIGNATION					
C51	R21	L14	P2	E6	Q5
TL12					
REFERENCE DESIGNATIONS NOT USED					
R17					

Figure 4. UHF PA Module, Schematic Diagram

TABLE 4

VHF PA Module, Parts List

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
A1	PA MOD A1	10029-2100
C1	Capacitor, Ceramic, 30 pF, 1000V	C-4749
C2	Capacitor, Silver Mica, 100 pF, 350V	C-6667
C3	Not Used	
C4	Capacitor, Ceramic, 0.01 μF, 25V	C-3531
C5	Capacitor, Tantalum, 0.22 μF, 35V	C-6417
C6	Capacitor, Tantalum, 15 μF, 20V	C-3103
C7	Capacitor, Silver Mica, 500 pF, 350V	C-6684
C8	Capacitor, Silver Mica, 250 pF, 350V	C-6673
C9	Capacitor, Silver Mica, 50 pF, 350V	C-6662
C10	Capacitor, Silver Mica, 100 pF, 350V	C-6667
C11	Capacitor, Silver Mica, 100 pF, 350V	C-6667
C12	Capacitor, Silver Mica, 150 pF, 350V	C-6669
C13	Capacitor, Silver Mica, 150 pF, 350V	C-6669
C14	Capacitor, Silver Mica, 500 pF, 350V	C-6684
C15	Capacitor, Tantalum, 15 μF, 20V	C-3103
C16	Capacitor, Tantalum, 0.22 μF, 35V	C-6417
C17	Capacitor, Silver Mica, 200 pF, 350V	C-6671
C18	Capacitor, Silver Mica, 50 pF, 350V	C-6662
C19	Capacitor, Silver Mica, 50 pF, 350V	C-6662
C20	Capacitor, Silver Mica, 150 pF, 350V	C-6669
C21	Capacitor, Silver Mica, 150 pF, 350V	C-6669
C22	Capacitor, Ceramic, 0.01 μF, 150V	C-0065
C23	Capacitor, Silver Mica, 500 pF, 350V	C-6684

TABLE 4

VHF PA Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
C24	Capacitor, Tantalum, μF, 20V	C-3103
C25	Capacitor, Tantalum, 0.22 μF, 35V	C-6417
C26	Capacitor, Silver Mica, 50 pF, 350V	C-6662
C27	Capacitor, Silver Mica, 50 pF, 350V	C-6662
C28	Capacitor, Silver Mica, 150 pF, 350V	C-6669
C29	Capacitor, Silver Mica, 150 pF, 350V	C-6669
C30	Capacitor, Silver Mica, 120 pF, 350V	C-6668
C31	Capacitor, Trimmer, 5–80 pF	C-6476
C32	Capacitor, Trimmer, 10–180 pF	C-6477
C33	Not Used	
C34	Capacitor, Ceramic, 2.2 pF, 1000V	C-4731
C35	Capacitor, Ceramic, 5 pF, 1000V	C-4737
C36	Capacitor, Ceramic, 150 pF, 500V	C-3502
C37	Capacitor, Silver Mica, 10 pF, 250V	C-6689
C38	Capacitor, Silver Mica, 20 pF, 250V	C-6693
C39	Capacitor, Ceramic, 0.01 μF, 50V	C-4952
CR1	Diode, Signal, 1N4454	CR-0705
CR2	Diode, Signal, 1N4454	CR-0705
CR3	Diode, Signal, 1N4454	CR-0705
CR4	Diode, Signal, 1N4454	CR-0705
E1	Terminal, PCB, 0.055 Thick	E-1306
E2	Connector Pin	MP-0287
E3	Terminal, PCB, 0.055 Thick	E-1306
E4	Terminal, PCB, 0.055 Thick	E-1306

TABLE 4

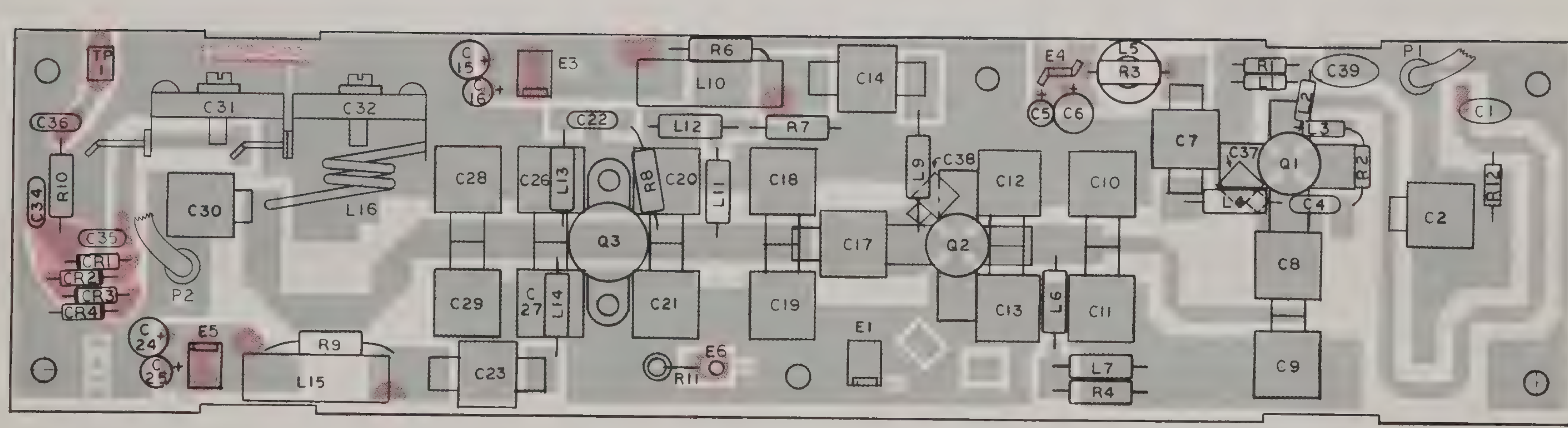
VHF PA Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
E5	Connector Pin	MP-0372
L1	Coil, rf, molded, 10 μH	L-0628
L2	Coil, rf, molded, 0.15 μH	L-0606
L3	Coil Assy	6611-0422
L4	Choke, rf, 0.15 μH	L-0074
L5	Toroid Assy	6611-0421
L6	Choke, rf, 0.15 μH	L-0074
L7	Choke, rf, 10 μH	L-0057
L8	Not Used	
L9	Choke, Wide-Band, 250 MHz	L-0183
L10	Choke Assy	6611-0420
L11	Choke, rf, 0.15 μH	L-0074
L12	Choke, rf, 10 μH	L-0057
L13	Choke, rf, 0.15 μH	L-0074
L14	Choke, Wide-Band, 250 MHz	L-0183
L15	Choke Assy	6611-0420
L16	Coil, 2 Turns	6611-0424
Q1	Transistor, PT4330A	Q-0411
Q2	Transistor, PT4330B	Q-0412
Q3	Transistor, PT4330C	Q-0413
R1	Resistor, 100 ohm ± 5%, ¼ W	R-1225
R2	Resistor, 100 ohm ± 5%, ¼ W	R-1225
R3	Resistor, 15 ohm ± 5%, ½ W	R-1405
R4	Resistor, 33 ohm ± 5%, ½ W	R-1413

TABLE 4

VHF PA Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
R5	Not Used	
R6	Resistor, 15 ohm ± 5%, ½ W	R-1405
R7	Resistor, 33 ohm ± 5%, ½ W	R-1413
R8	Resistor, 100 ohm ± 5%, ½ W	R-1425
R9	Resistor, 15 ohm ± 5%, ½ W	R-1405
R10	Resistor, 47K ohm ± 5%, ½ W	R-1489
R11	Thermistor, 100K ohm	R-7888
R12	Resistor, 47 ohm ± 5%, ¼ W	R-1217
TP1	Tip Jack, red	J-0387
P1	Coax Assy	10029-2115
P2	Coax Assy	10029-1116
	MAJOR MECHANICAL PARTS	
	(see Table 3)	



NOTE:
- COMPONENTS SHOWN IN SOLID BLACK
- FACING SIDE FOIL SHOWN IN BLACK SCREEN
- OPPOSITE SIDE FOIL SHOWN IN RED SCREEN

Figure 5. VHF PA Module, Component Location Diagram

NOTES:
1. UNLESS OTHERWISE SPECIFIED
ALL RESISTOR VALUES ARE IN OHMS, 1/2 W, 5 %.

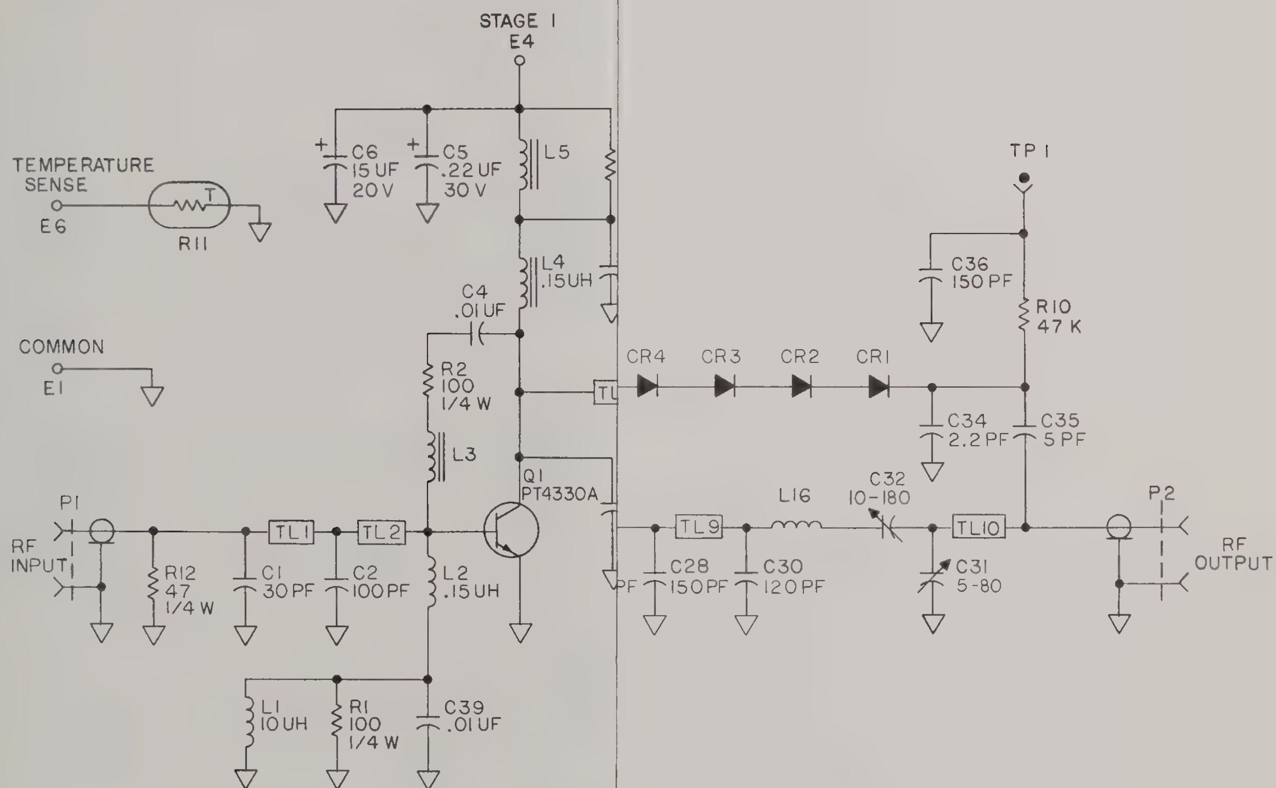
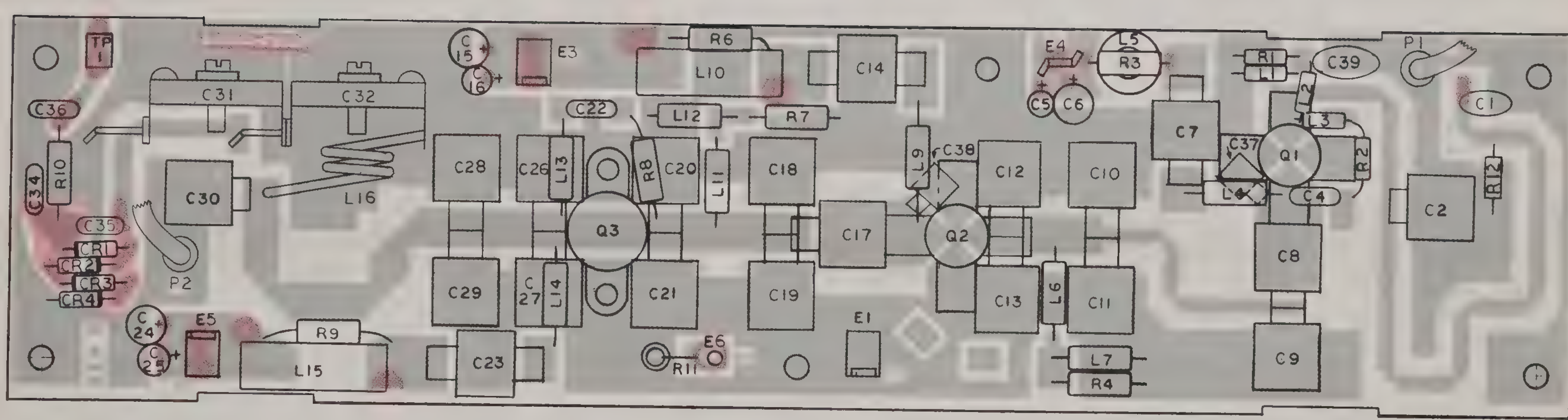


Figure 6. VHF PA Module, Schematic Diagram



NOTE:

- COMPONENTS SHOWN IN SOLID BLACK
- FACING SIDE FOIL SHOWN IN BLACK SCREEN
- OPPOSITE SIDE FOIL SHOWN IN RED SCREEN

Figure 5. VHF PA Module, Component Location Diagram

NOTES:
1. UNLESS OTHERWISE SPECIFIED
ALL RESISTOR VALUES ARE IN OHMS, 1/2 W, 5 %.

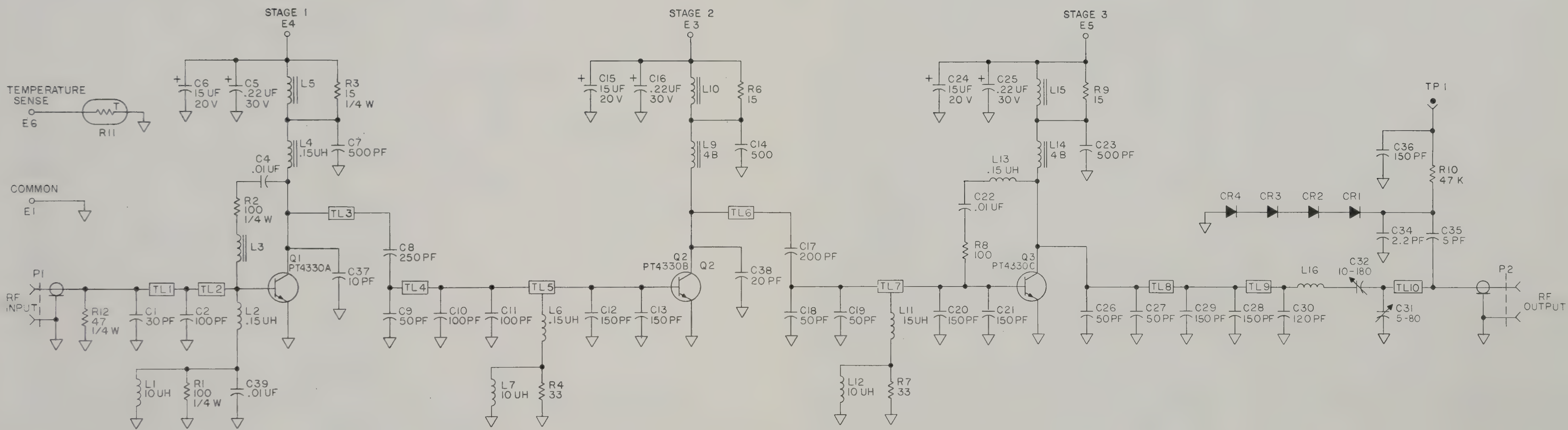
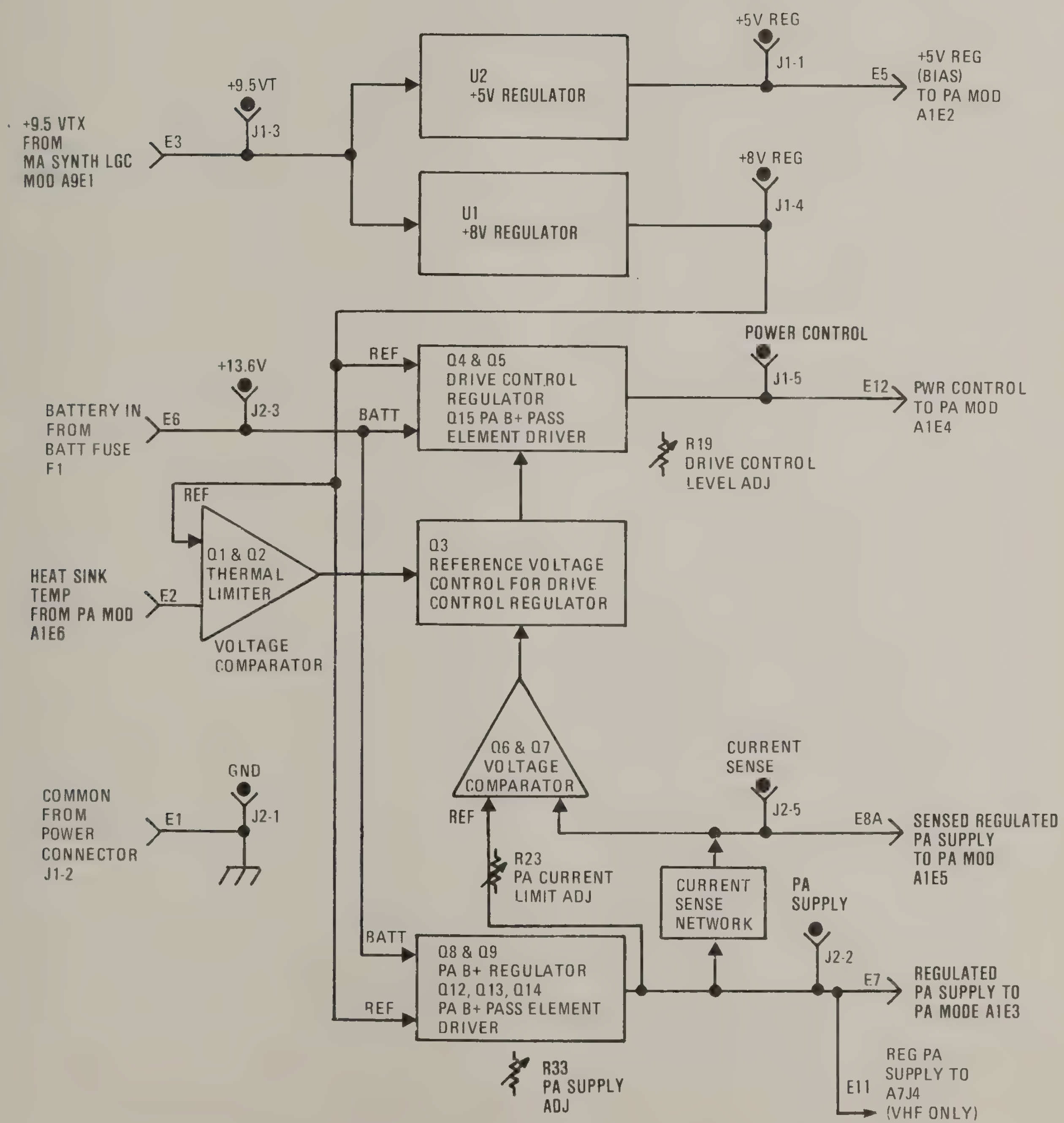


Figure 6. VHF PA Module, Schematic Diagram

A2

PA CONTROL MOD

10029-0200



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1. GENERAL DESCRIPTION

1.01 UHF and VHF PA Modules A1, driven by their respective Exciter Modules provide the high level rf transmit signal in the Transceiver. Each amplifier features solid-state active devices and broadband design techniques for maximum reliability and a minimum of realignment when changing bands. Extensive shielding and bypassing in each module reduces undesired signal leakage to a minimum. In each Transceiver a separate but identical PA Control Module A2 provides regulated, fixed, and adjustable voltages; and monitors the PA temperature and current. The simplified block diagrams of the UHF/VHF PA Modules are shown on the tab section front cover.

1.02 Each PA Module (UHF or VHF) contains a printed circuit board, on which all active and passive components are mounted. This is mounted to the flat surface of a die-cast aluminum heat sink. Separate mounting points are provided for each of the high power rf transistors. The heat sink in conjunction with a separate cavity at the rear of the die-cast chassis forms a shielded compartment for the PA Module. Dc voltages and control signals pass through feedthrough capacitors in the rear wall of the chassis, and are connected through individual connectors on each PA Module. The rf input and output signals are carried by coaxial cables. Hinges on the heat sink allow the PA Module to swing open for alignment and service. The PA Module is fastened to the chassis by two large captive screws located at opposite ends of the heat sink.

2. INTERFACE CONNECTIONS

A. UHF Interface Connections

2.01 The PA Module in conjunction with the rear panel casting of the Transceiver, forms an rf tight shielded enclosure for the power amplifier. Two coaxial cables, are attached to the PA Module. To maintain rf integrity, all other connections to the PA Module are bypassed by feedthrough capacitors in the PA compartment wall. Table 1 summarizes all UHF PA Module interface functions and gives significant TO/FROM information.

TABLE 1

UHF PA Module Interface Summary

REF DESIG	FUNCTION	TO	FROM
P1	RF In	—	A7J2
P2	RF Out	A11P1	—
E1	Ground	—	Chassis GND
E2	Bias (+5V Reg)	—	A2E5
E3	Regulated PA Supply	—	A2E7
E4	Power Control	—	A2E12
E5	Sensed PA Supply	—	A2E8
E6	Temp Sense	A2E2	—

B. VHF Interface Connections

2.02 The VHF PA Module is mounted the same as the UHF PA Module to maintain rf integrity. Table 2 summarizes all VHF PA Module interface functions and gives significant TO/FROM information.

TABLE 2

VHF PA Module Interface Summary

REF DESIG	FUNCTION	TO	FROM
P1	RF In	—	A7J2
P2	RF Out	A12P3	—
E1	GND	—	Chassis GND
E2	N/A	NC	NC
E3	Regulated PA Supply	—	A2E7
E4	Power Control	—	A2E12
E5	Sensed PA Supply	—	A2E8
E6	Temp Sense	A2E2	—

3. SUPPLEMENTARY SEMICONDUCTOR DATA

3.01 Neither the UHF nor the VHF Power Amplifier Module contains any complex semiconductor devices. Therefore, no supplementary semiconductor data is required.

4. TECHNICAL DESCRIPTION

A. UHF PA Module

4.01 In the UHF PA Module five broadband stages raise the nominal 20 milliwatt UHF Exciter Module A7 output to a nominal level of 42 watts. Approximate intermediate power levels are shown on the front cover simplified block diagram. Chebyshev low-pass filter networks between stages, assure good power transfer from stage-to-stage over a wide frequency range. They also provide harmonic attenuation, thereby reducing the rejection requirements for Low-Pass Filter Module A11. Trimmer capacitors in the output stage ensure a correct collector load, which therefore increases overall efficiency and reduces the operating temperature rise. A trimmer capacitor in the input of the first stage ensures a good load match for the Exciter Module and a high signal transfer to the PA Module input. Collector feed and base return networks are designed to ensure a clean output signal under adverse load conditions. These networks provide desirable loads for the active device at frequencies below the normal band of operation. A bias voltage derived from the PA Control Module is applied to the base circuits of the first and second stages to ensure proper operation under low signal level and low temperature conditions.

4.02 A thermistor in a protective shroud, extends from the underside of the PA printed circuit board, and into a thermal grease filled well (cavity) in the die-cast heat sink. Signals from the thermistor in conjunction with circuitry on PA Control Module limits the PA Module heat sink temperature to 95°C.

4.03 The collector circuits of the second and third PA Module stages are powered by a separate adjustable regulator on PA Control Module. The Transceiver power output is controlled by adjusting this voltage during the alignment procedure. A separate limited range, higher current regulator on the PA Control Module supplies Q1 and Q4 power transistor collector circuits and the Q5 collector circuit separately through a current sampling resistor.

4.04 The PA Module output signal leaves the PA Module via a coaxial cable terminated in a BNC bulkhead connector mounted on the PA compartment wall. The output signal passes through the Low-Pass Filter Module and Duplexer A12 to antenna connector J1 (on the front panel).

B. VHF PA Module

4.05 In the VHF PA Module, three broadband stages raise the nominal 250 milliwatt VHF Exciter Module output to a nominal level of 70 watts. With the following exceptions, the circuit description for the UHF PA Module will also apply to the VHF PA Module.

(a) The VHF PA Module uses trimmer capacitors in the output stage only.

(b) Because of the higher rf power levels at the VHF PA Module input, no bias voltages are required.

(c) The power output control voltage from the PA Control Module is applied only to the first stage in the VHF PA Module.

(d) The PA Module output signal passes through the Duplexer and Low-Pass Filter Modules in that order.

5. MAINTENANCE

A. General Information

5.01 The UHF and VHF PA Modules do not require routine periodic maintenance.

B. Power Transistor Removal and Installation (UHF or VHF)

CAUTION

Always disconnect power when removing or installing subassemblies.

(a) Flange mount transistors (VHF Q3, and UHF Q4 and Q5).

(1) Use a 800°F soldering iron with a 3/16 inch wedge type tip in the removal and/or installation procedure. Be sure to keep the tip of the iron clean.

must be made in conjunction with the adjustments on the PA Module. Removal of the Transceiver covers makes maintenance and adjustments to the PA Control Module possible.

CAUTION

Always disconnect power when removing or installing subassemblies.

B. PA Regulator Pass Element Replacement

5.02 To replace the 2N5986 transistors (Q12, Q13, Q14, and Q15) on the PA Control Module, first unscrew the retaining assembly holding the device to be replaced. Keep retaining parts assembled in the proper sequence. Next, using a wide tip soldering iron at 800°F, heat all three leads in sequence until the solder flows. This may take some time. When the solder on all three leads is flowing, grasp the device with a pair of pliers and pull it from the board. Do not force leads from the board for this will damage the PC trace. Next, remove any solder lumps from the board and clean the area on the heat sink where the transistor will sit. Put a thin coating of thermal grease (DOW CORNING 340) on the copper side of the transistor and on the heat sink. Place a mica washer on the heat sink where the device will rest. Place the transistor copper side down on top of the mica washer. Alternately put a silcone insulating pad on the heat sink where the transistor will sit. Place transistor (copper side down) on top of the pad. Make sure transistor leads are oriented in the proper place. Screw in the transistor retaining assembly. Torque to 6 inch-pounds. Solder the three leads individually.

C. UHF/VHF PA Control Module Alignment

5.03 Refer to the PA Module tab section for PA Control Module Alignment. This alignment is described along with PA Module alignment procedures.

D . UHF/VHF PA Module Thermal Cutback Check

(a) To check operation of UHF/VHF PA thermal cutback circuit, connect voltmeter to J1-5.

(b) Key Transmitter and place 3.9K ohm resistor from E2 to ground.

(c) The voltage on J1-5 should decrease. If not, there is a problem in the thermal cutback circuitry or the thermistor in the PA Module may be defective. Refer to the PA Module cover for thermistor specifications.

6. PARTS LIST

A. UHF/VHF PA Control Module Parts List

6.01 The UHF/VHF PA Control Module parts list information is given in table 4. Figure 1 gives the UHF/VHF PA Control Module Component location information.

NOTE

Transistors Q12-Q15 are part of the Chassis Assembly, and are in the Chassis Parts List in Section A, Table 2.

7. SCHEMATIC DIAGRAMS

A. UHF/VHF PA Control Schematic

7.01 Figure 2 is the UHF/VHF PA Control Module schematic diagram.

TABLE 4

UHF/VHF PA Control Module, Parts List

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
A2	PA CONT MOD	10029-0200
C1	Capacitor, Ceramic, axial 10 pF	C12-0001-013
C2	Capacitor, Ceramic, axial 10 pF	C12-0001-013
C3	Capacitor, Tantalum, 15 μF, 20V	C-3103
C4	Capacitor, Ceramic, axial, 10 pF	C12-0001-013
C5	Capacitor, Ceramic, axial, 10 pF	C12-0001-013
C6	Capacitor, Tantalum, 15 μF, 20V	C-3103
C7	Capacitor, Ceramic, axial, 10 pF	C12-0001-013
C8	Capacitor, Tantalum, 1 μF, 35V	C-3100
C9	Capacitor, Ceramic, axial, 10 pF	C12-0001-013
C10	Capacitor, Ceramic, axial, 0.001 μF	C12-0001-049
C11	Capacitor, Ceramic, axial, 10 pF	C12-0001-013
C12	Capacitor, Tantalum, 47 μF, 20V	C-6452
C13	Capacitor, Ceramic, axial, 10 pF	C12-0001-013
C14	Capacitor, Tantalum, 15 μF, 20V	C-3103
C15	Capacitor, Ceramic, axial, 10 pF	C12-0001-013
C16	Capacitor, Ceramic, axial, 10 pF	C12-0001-013
C17	Capacitor, Ceramic, axial, 10 pF	C12-0001-013
C18	Capacitor, Ceramic, axial, 10 pF	C12-0001-013
C19	Capacitor, Ceramic, axial, 10 pF	C12-0001-013
C20	Capacitor, Ceramic, axial, 0.001 μF	C12-0001-049
C21	Capacitor, Ceramic, axial, 10 pF	C12-0001-013
C22	Capacitor, Tantalum, 1 μF, 35V	C-3100
C23	Capacitor, Ceramic, axial, 10 pF	C12-0001-013

TABLE 4

UHF/VHF PA Control Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
C24	Capacitor, Tantalum, 10 μF, 50V	C25-0003-013
C25	Not Used	
C26	Capacitor, Ceramic, 0.47 μF, 50V	C11-0005-474
C27	Capacitor, Ceramic, 0.47 μF, 50V	C11-0005-474
C28	Capacitor, Ceramic, 0.47 μF, 50V	C11-0005-474
CR1	Diode, Zener, IN5235B	CR-0266
CR2	Diode, Zener, IN5235B	CR-0266
E1	Pin, Connector	MP-0372
E2	Connector Pin	MP-0287
E3	Connector Pin	MP-0287
E4	Connector Pin	MP-0287
E5	Connector Pin	MP-0287
E6	Terminal, PCB, 0.055 thick	E-1306
E7	Terminal, PCB, 0.055 thick	E-1306
E8	Terminal, PCB, 0.055 thick	E-1306
E9	Not Used	
E10	Not Used	
E11	Connector Pin	MP-0287
E12	Connector Pin	MP-0287
E13	Connector Pin	MP-0287
E14	Connector Pin	MP-0287
J1	Connector Strip, 5-position	P-0224
J2	Connector Strip, 5-position	P-0224
Q1	Transistor, 2N4126	Q-0386

TABLE 4

UHF/VHF PA Control Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
Q2	Transistor, 2N4126	Q-0386
Q3	Transistor, 2N4124	Q-0385
Q4	Transistor, MPS-U01	Q-0074
Q5	Transistor, MPS-U01	Q-0074
Q6	Transistor, 2N4126	Q-0386
Q7	Transistor, 2N4126	Q-0386
Q8	Transistor, MPS-U01	Q-0074
Q9	Transistor, MPS-U01	Q-0074
R1	Resistor, Film, 604 ohm ± 1%, ⅛W	R-7272
R2	Resistor, Film, 13.7 K ohm ± 1%, ⅛W	R-7286
R3	Resistor, Composition, 1.5 K ohm ± 5%, ¼W	R-1253
R4	Resistor, Composition, 1 K ohm ± 5%, ¼W	R-1249
R5	Resistor, Composition, 2.2 K ohm ± 5%, ¼W	R-1257
R6	Resistor, Composition, 2.2 K ohm ± 5%, ¼W	R-1257
R7	Resistor, Film, 13.7 K ohm ± 1%, ⅛W	R-7286
R8	Resistor, Composition, 1 K ohm ± 5%, ¼W	R-1249
R9	Resistor, Film, 5.620 K ohm ± 1%, ⅛W	R-7300
R10	Resistor, Composition, 2.2 K ohm ± 5%, ¼W	R-1257
R11	Resistor, Composition, 510 ohm ± 5%, ¼W	R-1242
R12	Resistor, Composition, 68 ohm ± 5%, ¼W	R-1221
R13	Resistor, Composition, 180 ohm ± 5%, ¼W	R-1231
R14	Resistor, Composition, 56 ohm ± 5%, 1W	R-1619
R15	Resistor, Composition, 1 K ohm ± 5%, ¼W	R-1249
R16	Resistor, Composition, 47 ohm ± 5%, 1W	R-1617
R17	Resistor, Composition, 39 ohm ± 5%, 1W	R-1615

TABLE 4

UHF/VHF PA Control Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
R18	Resistor, Composition, 470 ohm ± 5%, ¼W	R-1241
R19	Potentiometer, Cermet, 200 ohm	R-2204
R20	Resistor, Composition, 120 ohm ± 5%, ¼W	R-1227
R21	Resistor, Composition, 2.2 K ohm ± 5%, ¼W	R-1257
R22	Resistor, Composition, 1.5 K ohm ± 5%, ¼W	R-1253
R23	Potentiometer, Cermet, 500 ohm	R-2205
R24	Resistor, Composition, 270 ohm ± 5%, ¼W	R-1235
R25	Resistor, Composition, 270 ohm ± 5%, ¼W	R-1235
R26	Resistor, Composition, 1 K ohm ± 5%, ¼W	R-1249
R27	Resistor, Composition, 1 K ohm ± 5%, ¼W	R-1249
R28	Resistor, Composition, 1 K ohm ± 5%, ¼W	R-1249
R29	Resistor, Composition, 1.8 K ohm ± 5%, ¼W	R-1255
R30	Resistor, Composition, 560 ohm ± 5%, ¼W	R-1243
R31	Resistor, Composition, 270 ohm ± 5%, ¼W	R-1235
R32	Resistor, Composition, 1.5 K ohm ± 5%, ¼W	R-1253
R33	Potentiometer, Cermet, 200 ohm	R-2204
R34	Resistor, Composition, 330 ohm ± 5%, ¼W	R-1237
R35	Resistor, Composition, 75 ohm ± 5%, 1W	R-1622
R36	Resistor, Composition, 240 ohm ± 5%, ¼W	R-1234
R37	Resistor, Composition, 22 ohm ± 5%, ½W	R-1409
R38	Resistor, Composition, 100 ohm ± 5%, ¼W	R-1225
R39	Resistor, Composition, 180 ohm ± 5%, 1W	R-1631
R40	Resistor, Composition, 330 ohm ± 5%, ¼W	R-1237
R41	Not Used	

TABLE 4

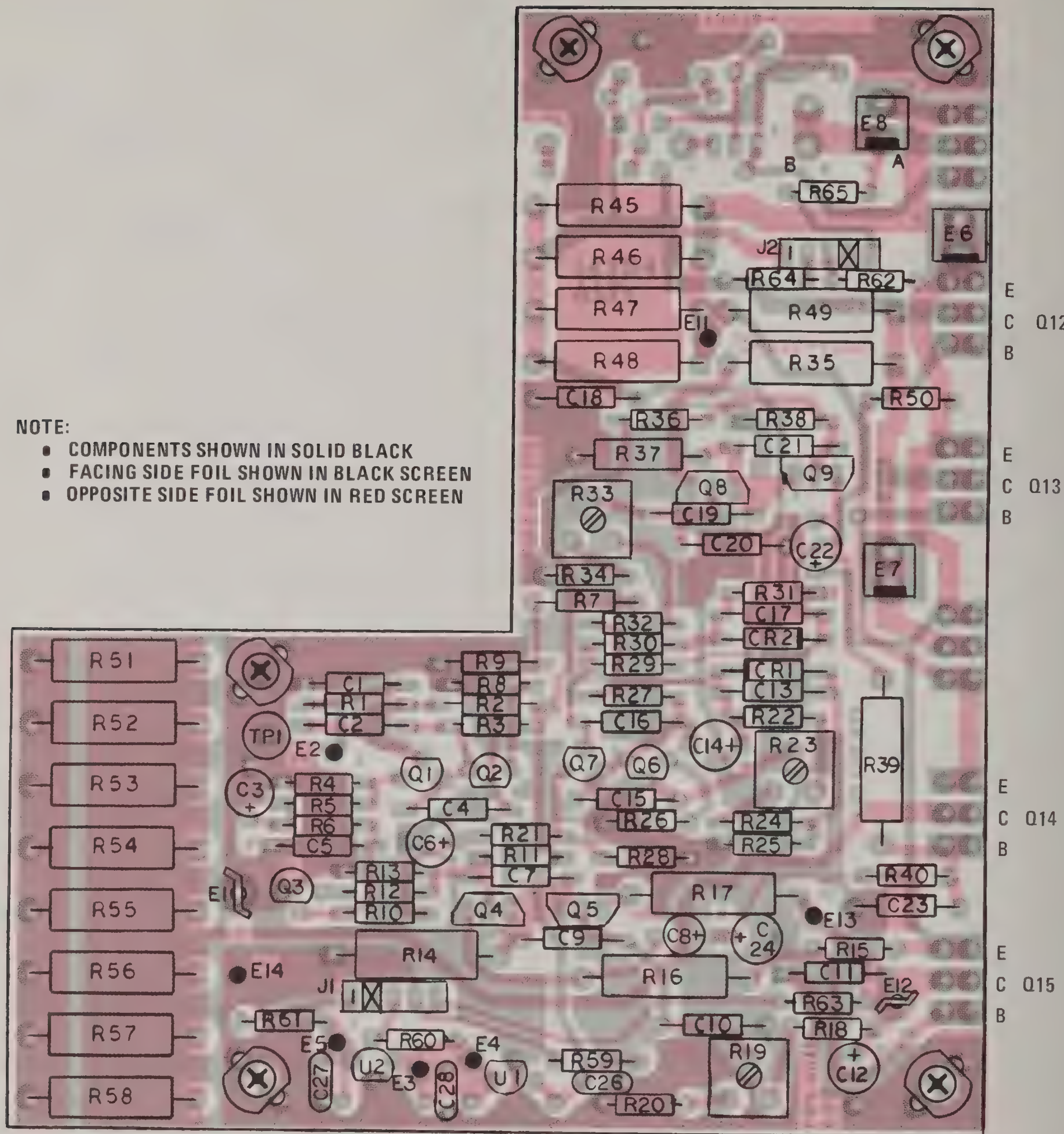
UHF/VHF PA Control Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
R42	Not Used	
R43	Not Used	
R44	Not Used	
R45	Resistor, Composition 0.1 ohm ± 5%, 2W	R-2055
R46	Resistor, Composition 0.1 ohm ± 5%, 2W	R-2055
R47	Resistor, Composition 0.1 ohm ± 5%, 2W	R-2055
R48	Resistor, Composition 0.1 ohm ± 5%, 2W	R-2055
R49	Resistor, Composition 0.1 ohm ± 5%, 2W	R-2055
R50	Resistor, Composition 0.1 ohm ± 5%, 2W	R-2055
R51	Resistor, Composition, 150 ohm ± 5%, 2W	R-3959
R52	Resistor, Composition, 150 ohm ± 5%, 2W	R-3959
R53	Resistor, Composition, 150 ohm ± 5%, 2W	R-3959
R54	Resistor, Composition, 150 ohm ± 5%, 2W	R-3959
R55	Resistor, Composition, 150 ohm ± 5%, 2W	R-3959
R56	Resistor, Composition, 150 ohm ± 5%, 2W	R-3959
R57	Resistor, Composition, 150 ohm ± 5%, 2W	R-3959
R58	Resistor, Composition, 150 ohm ± 5%, 2W	R-3959
R59	Resistor, Composition, 1 K ohm ± 5%, ¼W	R-1249
R60	Resistor, Composition, 1 K ohm ± 5%, ¼W	R-1249
R61	Resistor, Composition, 1 K ohm ± 5%, ¼W	R-1249
R62	Resistor, Composition, 1 K ohm ± 5%, ¼W	R-1249
R63	Resistor, Composition, 1 K ohm ± 5%, ¼W	R-1249
R64	Resistor, Composition, 1 K ohm ± 5%, ¼W	R-1249
R65	Resistor, Composition, 1 K ohm ± 5%, ¼W	R-1249

TABLE 4

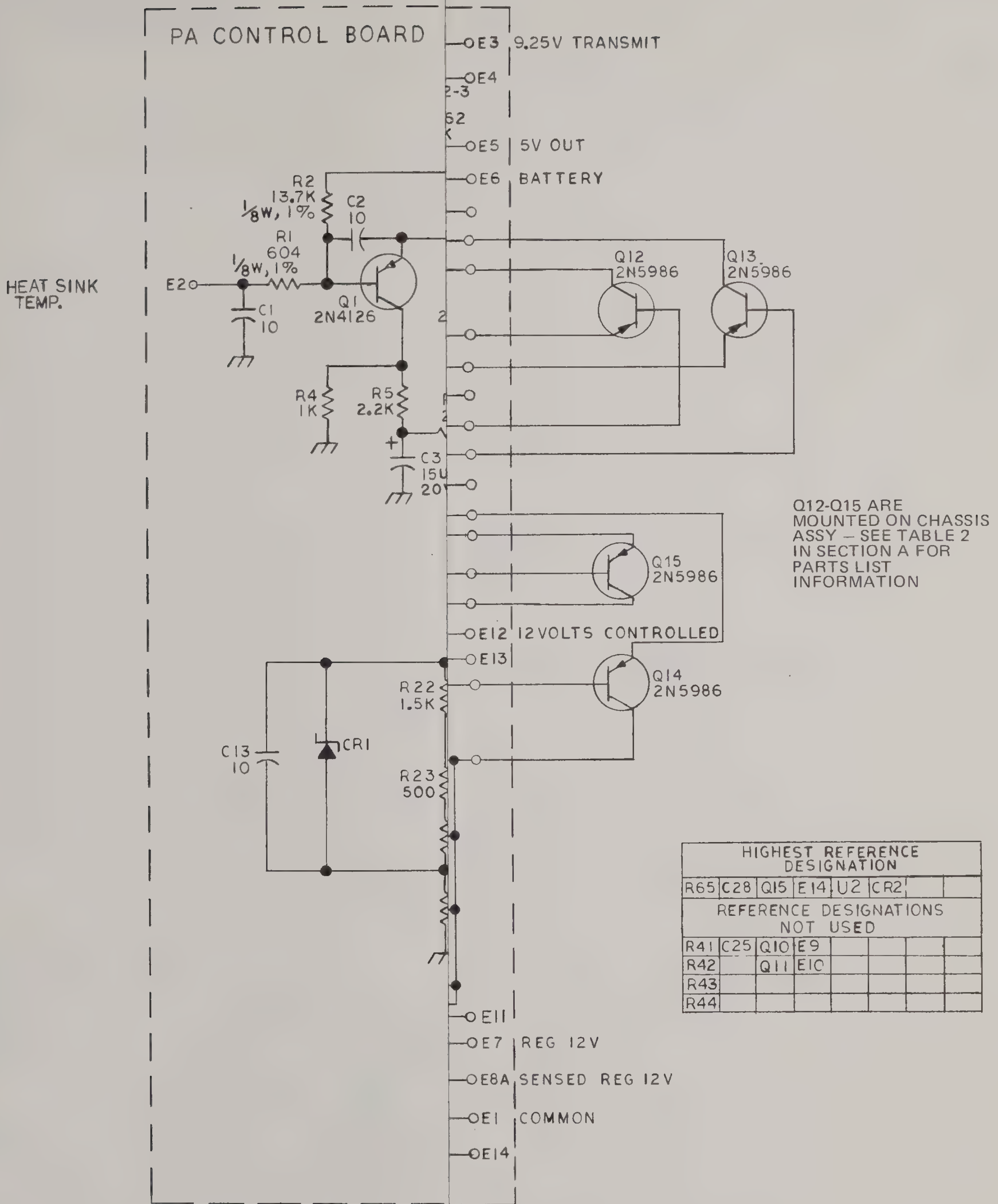
UHF/VHF PA Control Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
TP1	Tip Jack, black	J-0067
U1	Integrated Circuit, Voltage Regulator, MC78LO8ACP	I12-0006-008
U2	Integrated Circuit, Voltage Regulator, NSC LM240LAZ5.0	IC-0291



NOTE:
- COMPONENTS SHOWN IN SOLID BLACK
- FACING SIDE FOIL SHOWN IN BLACK SCREEN
- OPPOSITE SIDE FOIL SHOWN IN RED SCREEN

Figure 1. UHF/VHF PA Control Module, Component Location Diagram



HIGHEST REFERENCE DESIGNATION							
R65	C28	Q15	E14	U2	CR2		
REFERENCE DESIGNATIONS NOT USED							
R41	C25	Q10	E9				
R42		Q11	E10				
R43							
R44							

NOTES: UNLESS OTHERWISE SPECIFIED:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COM
DESIGNATION PREFIX WITH UNIT NUMBER AND/OR ASSEMBLY
DESIGNATIONS.
2. RESISTOR VALUES ARE IN OHMS, 1/4 W, 5%.
3. CAPACITOR VALUES ARE IN PF.
4. VENDOR AND/OR JEDEC PART NUMBER CALLOUTS ARE FOR R
ONLY; COMPONENTS ARE SUPPLIED PER PART NUMBER IN

Figure 2. UHF/VHF PA Control Module, Schematic Diagram

NOTE:
- COMPONENTS SHOWN IN SOLID BLACK
- FACING SIDE FOIL SHOWN IN BLACK SCREEN
- OPPOSITE SIDE FOIL SHOWN IN RED SCREEN

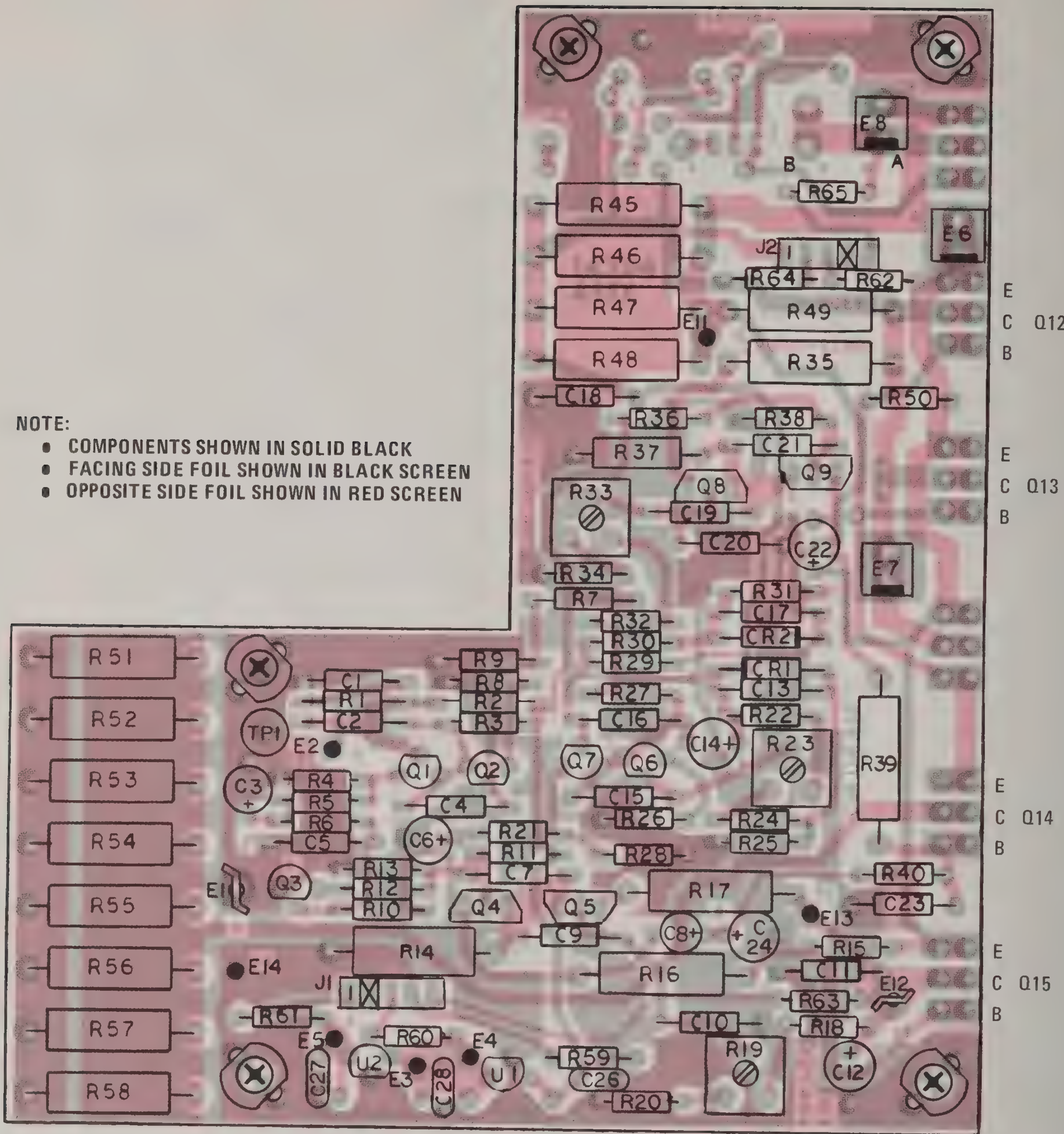
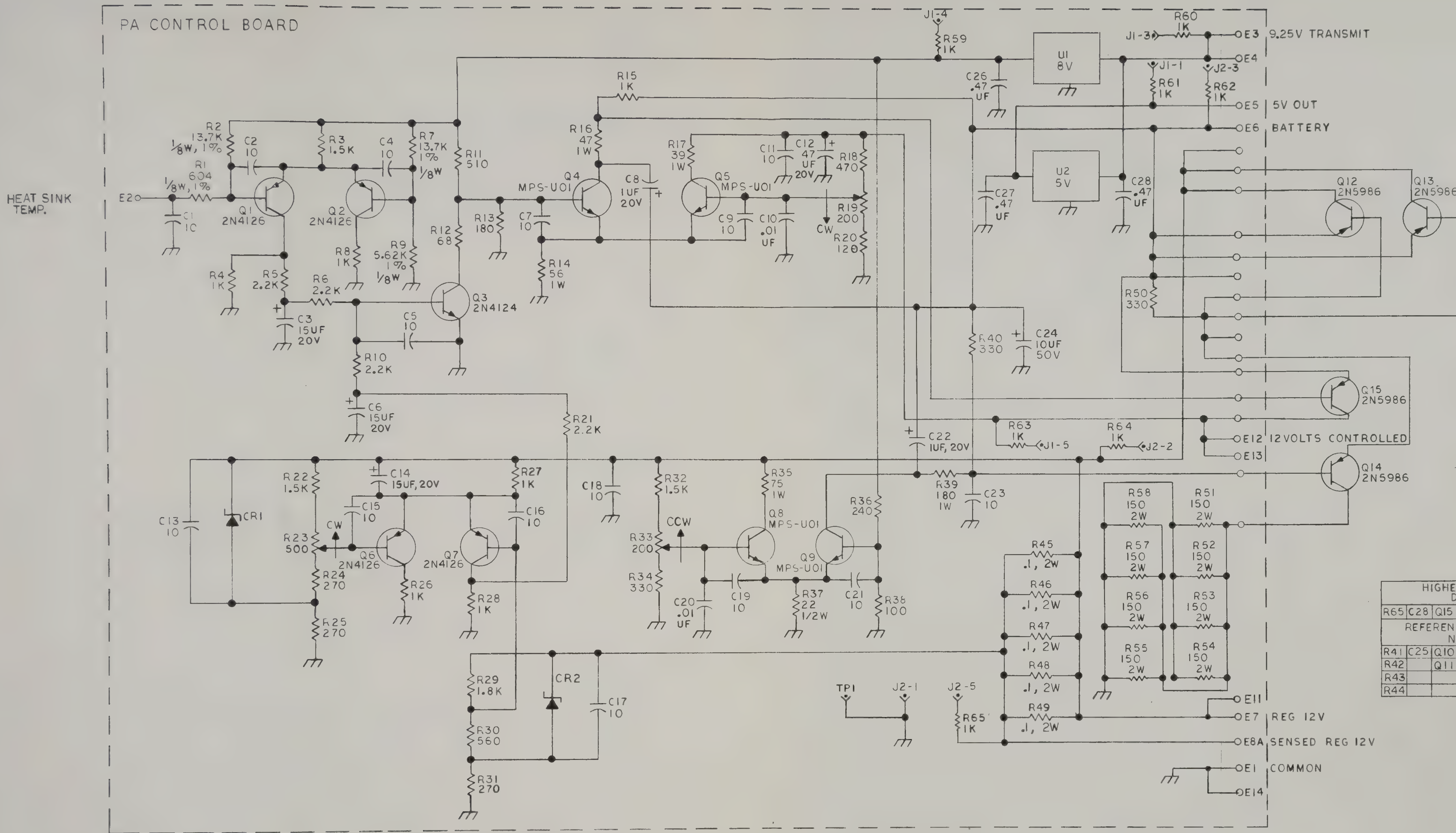


Figure 1. UHF/VHF PA Control Module, Component Location Diagram



HIGHEST REFERENCE DESIGNATION							
R65	C28	Q15	E14	U2	CR2		
REFERENCE DESIGNATIONS NOT USED							
R41	C25	Q10	E9				
R42		Q11	E10				
R43							
R44							

NOTES: UNLESS OTHERWISE SPECIFIED:

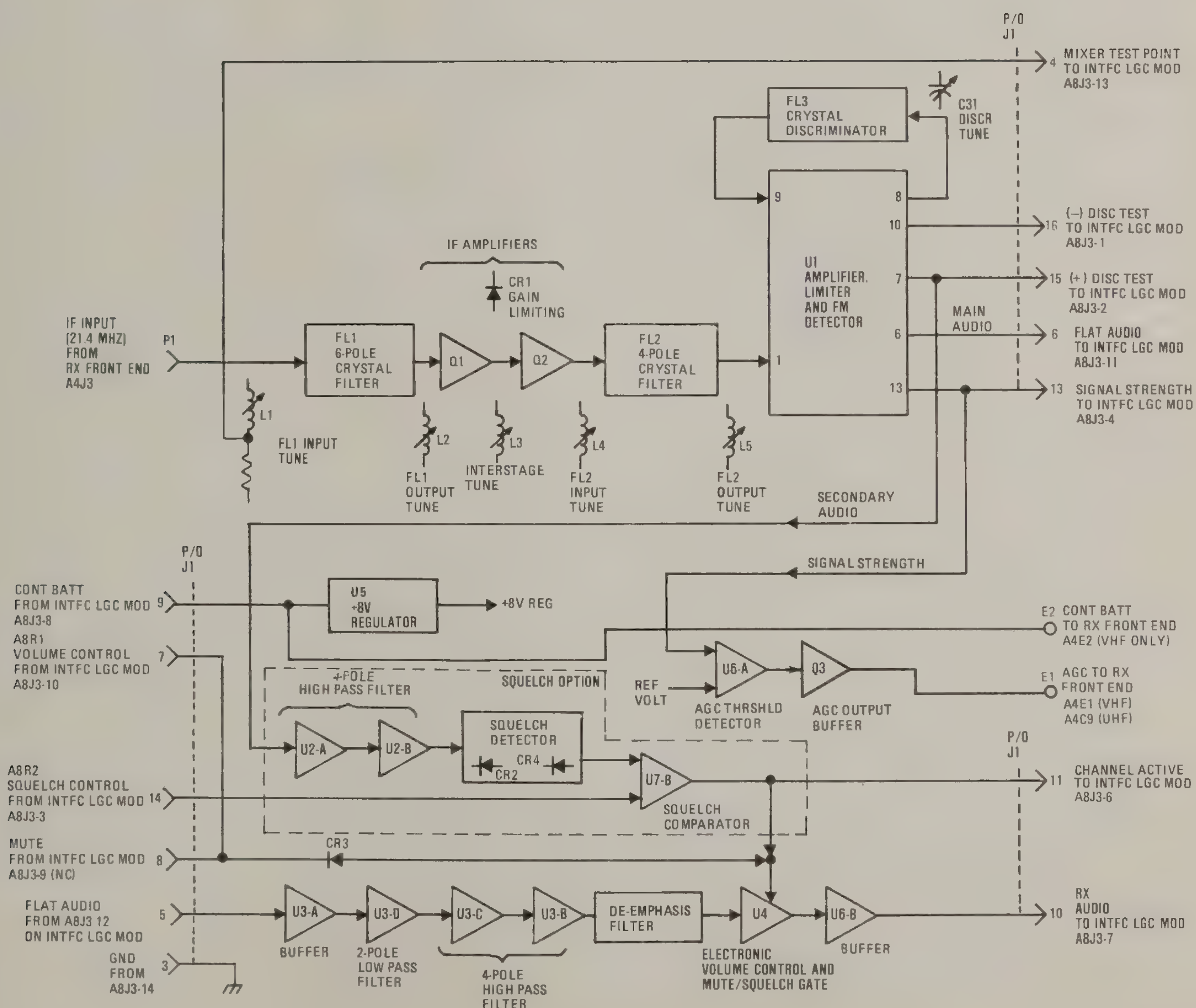
1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER AND/OR ASSEMBLY DESIGNATIONS.
2. RESISTOR VALUES ARE IN OHMS, 1/4 W, 5%.
3. CAPACITOR VALUES ARE IN PF.
4. VENDOR AND/OR JEDEC PART NUMBER CALLOUTS ARE FOR REFERENCE ONLY; COMPONENTS ARE SUPPLIED PER PART NUMBER IN PARTS LIST.

Figure 2. UHF/VHF PA Control Module, Schematic Diagram

A3

IF/AUDIO MOD

With noise squelch: 10029-0300
Without noise squelch: 10029-0330



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1. GENERAL DESCRIPTION

1.01 IF/Audio Module A3 provides the necessary gain, selectivity, detection, audio processing and AGC capabilities to complement Receive Front End Module A4 and form a complete Receiver. An optional squelch circuit mutes the Receiver audio output when no acceptable signal is present.

1.02 A functional block diagram of the IF/Audio Module is shown on the front cover of this tab section. The primary signal path (upper portion) handles amplification, filtering, and detection of the 21.4 MHz IF signal entering at P1 from the Receive Front End Module. Flat Audio leaves the module at J1-6 for use elsewhere in the Transceiver. Normally, the same Flat Audio signal is returned to the IF/Audio Module at J1-5. The circuit on the bottom portion of the block diagram performs voice filtering, de-emphasis, and volume control functions, with the Receive Audio signal leaving the module at J1-10. The AGC section, at the right of the diagram, supplies an automatic gain control voltage (AGC) to the Receive Front End Module, while the regulator at the left of the diagram provides a stable supply for voltage-sensitive circuits in the IF/Audio Board Module. The squelch circuit compares audio quieting to a pre-settable reference permitting the Receive Audio Output to reach J1-10 only when a signal of adequate quality is being received.

2. INTERFACE CONNECTIONS

2.01 Connections from the IF/Audio Module go to the Receive Front End Module and Interface Logic Module A8. The Receive Front End Module connections differ between UHF and VHF Transceivers and are itemized in table 1 below.

TABLE 1

IF/Audio Module To Receive Front End Module Interface Summary

REF DESIG	FUNCTION	VHF TO/FROM		UHF TO/FROM	
P1	IF Input	—	A4J3	—	A4J3
E1	AGC Out	A4E1	—	A4C9	—
E2	Cont Batt Out	A4E2	—	Not Used	Not Used

2.02 Connections to the Interface Logic Module are summarized in table 2. In the Interface Logic Module, some of the circuits are carried through to a test point connector for servicing convenience. Table 2 shows both the direct connection point at A8J3 and, if applicable, the test access point on connector A8J4.

TABLE 2

IF/Audio Module To Interface Logic Module Interface Summary

REF DESIG	FUNCTION	TO/FROM		TEST POINT
J1-1	Not Used	—	—	—
J1-2	Pin Omitted	—	—	—
J1-3	GND	—	A8J3-14	A8J4-1
J1-4	Mixer TP Out	A8J3-13	—	A8J4-15
J1-5	Flat Audio In	—	A8J3-12	—
J1-6	Flat Audio Out	A8J3-11	—	—
J1-7	Volume Control In	—	A8J3-10	—
J1-8	Mute In	—	A8J3-9	—
J1-9	Cont Batt In	—	A8J3-8	A8J4-4
J1-10	RCV Audio Out	A8J3-7	—	A8J4-18
J1-11	Channel Active Out	A8J3-6	—	—
J1-12	Not Used	—	—	—
J1-13	Signal Strength Out	A8J3-4	—	A8J4-16
J1-14	Squelch Control In	—	A8J3-3	—
J1-15	Disc + Out	A8J3-2	—	A8J4-17
J1-16	Disc − Out	A8J3-1	—	A8J4-14

3. SUPPLEMENTARY SEMICONDUCTOR DATA

3.01 Transistor lead identification diagrams will be found in Chapter 4, Maintenance. Chapter four also contains data on the complex semiconductor devices listed in table 3.

TABLE 3

IF/Audio Module, Complex Semiconductor Devices

REF DESIG	DEVICE	TYPE
U1	3089	FM IF System
U2	3024	Dual OP AMP
U3	324	Quad OP AMP
U4	3080	Variable Gain OP AMP
U5	MC78L08ACP	8 Volt Regulator
U6	358	Dual OP AMP
U7	358	Dual OP AMP

4. TECHNICAL DESCRIPTION

4.01 A short coaxial cable, terminated by P1, connects to A4J3 on the Receive Front End Module. The 21.4 MHz IF signal enters the IF/Audio Module through this cable. At the same time, dc operating power for Mixer A4Q3 (VHF) or A4A1Q1 (UHF) in the Receive Front End Module is supplied via the center conductor of the cable. Current to the mixer flows through resistor R11 producing a small voltage drop which may be measured between Mixer Test Point J1-4 and Cont Batt Test Point J1-9. The use of this measurement is covered in the Receive Front End Module tab section.

4.02 Transistors Q1 and Q2, together with Crystal Filters FL1 and FL2, form a selective amplifier at 21.4 MHz, which has a bandwidth of 13 KHz and a gain of approximately 50 dB. Diode CR1 acts as a limiter when a strong signal is being received, preventing Q2 from being overdriven. Variable inductors L1 through L5 allow tuning of each portion of the amplifier circuit to 21.4 MHz. The amplified and filtered signal from FL2 drives Integrated Circuit U1. This FM IF system provides approximately 90 dB of additional gain at 21.4 MHz, limiting and FM detection. The FM detection function is performed in conjunction with Crystal Discriminator Filter FL3. Symmetry adjustment is provided by Discr Tune variable capacitor C31.

4.03 Three functional outputs are obtained from U1. The primary audio signal at pin 6 is used for normal audio purposes in the Receiver. A dc voltage at pin 13, which varies from approximately two volts with no received signal, to approximately five volts with a strong signal, is used to control the AGC action. A secondary audio signal at pin 7 drives the noise-activated squelch circuit when that option has been installed.

4.04 The Flat (wideband) Audio signal from U1-6 is passed via J1-6 to the Interface Logic Module, in order to leave open the possibility of performing special processing there. Normally, however, the Flat Audio signal is returned unmodified via J1-5 to the IF/Audio Module. Integrated Circuit U3 performs active low-pass and high-pass filtering functions, thus, eliminating frequencies above 3000 Hz and below 300 Hz. The remaining signal is then passed through a de-emphasis filter to Electronic Volume control U4. This device may function as a continuous variable volume control (accessed via J1-7), as a muting gate (via J1-8), or as a squelch gate (internally accessed; see paragraph 4.06). Amplifier U6-B provides sufficient output power to drive a 2200 ohm external load at J1-10.

4.05 The Signal Strength voltage output from U1-13 provides one input to the AGC threshold detector and integrator U6-A. The other input is a reference level of approximately three Vdc. Whenever the Signal Strength level is below the reference (a weak or no signal condition) the dc output of U6-A will be high and maximum voltage will be supplied to the Receiver Front End Module through emitter follower Q3. At some signal level between one and ten microvolts, depending on individual Receiver gain, the Signal Strength level will exceed three volts. At this threshold the dc output of U6-A will begin to drop, reducing the gain of the rf amplifier. This process will continue as signal level increases, until the rf amplifier gain has been reduced to the desired amount. At this point the U6-A output will stabilize and still stronger signals will produce no further AGC action.

4.06 The preceding paragraphs described operation of the IF/Audio Module without squelch (P/N 10029-0330). With the optional squelch circuit included, (P/N 10029-0300) a secondary audio output from U1-7 drives active high-pass filter U2-A and U2-B. With a cutoff frequency of 13.5 KHz, this filter eliminates all

audio components of the detected signal, leaving only higher frequency noise. This noise signal is converted by Squelch Detector CR2 and CR4 to a proportional dc voltage which is applied to one input of Squelch Comparator U7-B. Appropriate adjustment of voltage at the other input, by means of external Squelch control via J1-14 permits U7-B to hold Volume control U4 disabled until a signal of acceptable quality is received. A status output from U7-B is available at J1-11 for external indication of channel activity.

5. MAINTENANCE

A. General Information

5.01 The adjustments indicated by the alignment procedure described in the following paragraphs are made at the factory prior to shipment. It should not be necessary to repeat any of these adjustments unless there has been a component failure.

5.02 Alignment of the IF/Audio Module is accomplished using a signal inserted into antenna connector J1 at the frequency of a normal operating channel. Field alignment of the module alone at 21.4 MHz is not practical, since a special matching fixture simulating the Receiver Front End Module output impedance is required. The alignment procedure below presumes that work is being performed on a complete Transceiver, with a Control Unit and an adequate power supply connected.

5.03 In order to achieve correct results, both signal and local oscillator frequencies must be accurate. The synthesizer tune up procedure,as described in Slave/Master Synthesizer Logic Module A6/A9tab section, should be completed and rf signal generator frequency should be within ±250 Hz.

CAUTION

Do not attempt to drive the IF/Audio Module at 21.400 MHz directly, unless the signal generator is known to have an ac-coupled output. Dc voltage is present on the center conductor of the module input cable and damage to the module and/or the generator may result.

B. IF/Audio Module Alignment Procedure

NOTE

The Receiver Front End Module should not be readjusted during this procedure. Correct procedure for readjustment is contained in the Front End Module tab section.

5.04 Refer to figure 1 for adjustment locations.

(a) Using Control Unit, select any normal operating channel.

(b) Disconnect Tx control line at A2E3 to disable Transmitter.

(c) Connect FM signal generator to Transceiver antenna connector J1. Set generator to selected channel frequency, with modulation at 1000 Hz with ±5 KHz deviation.

(d) Connect dc voltmeter between Signal Strength test point A8J4-16 (+) and Ground test point A8J4-1.

(e) Adjust signal generator output level for 4.0 to 4.2 Vdc indication on voltmeter.

(f) Using a NONMETALLIC tuning tool, adjust variable inductors L1 through L5 for maximum indication. If necessary, readjust signal generator output level to maintain 4.0 to 4.2 volt reading.

(g) Disconnect dc voltmeter, and reconnect to Disc + Out test point A8J4-17 and Disc – Out test point A8J4-14.

NOTE

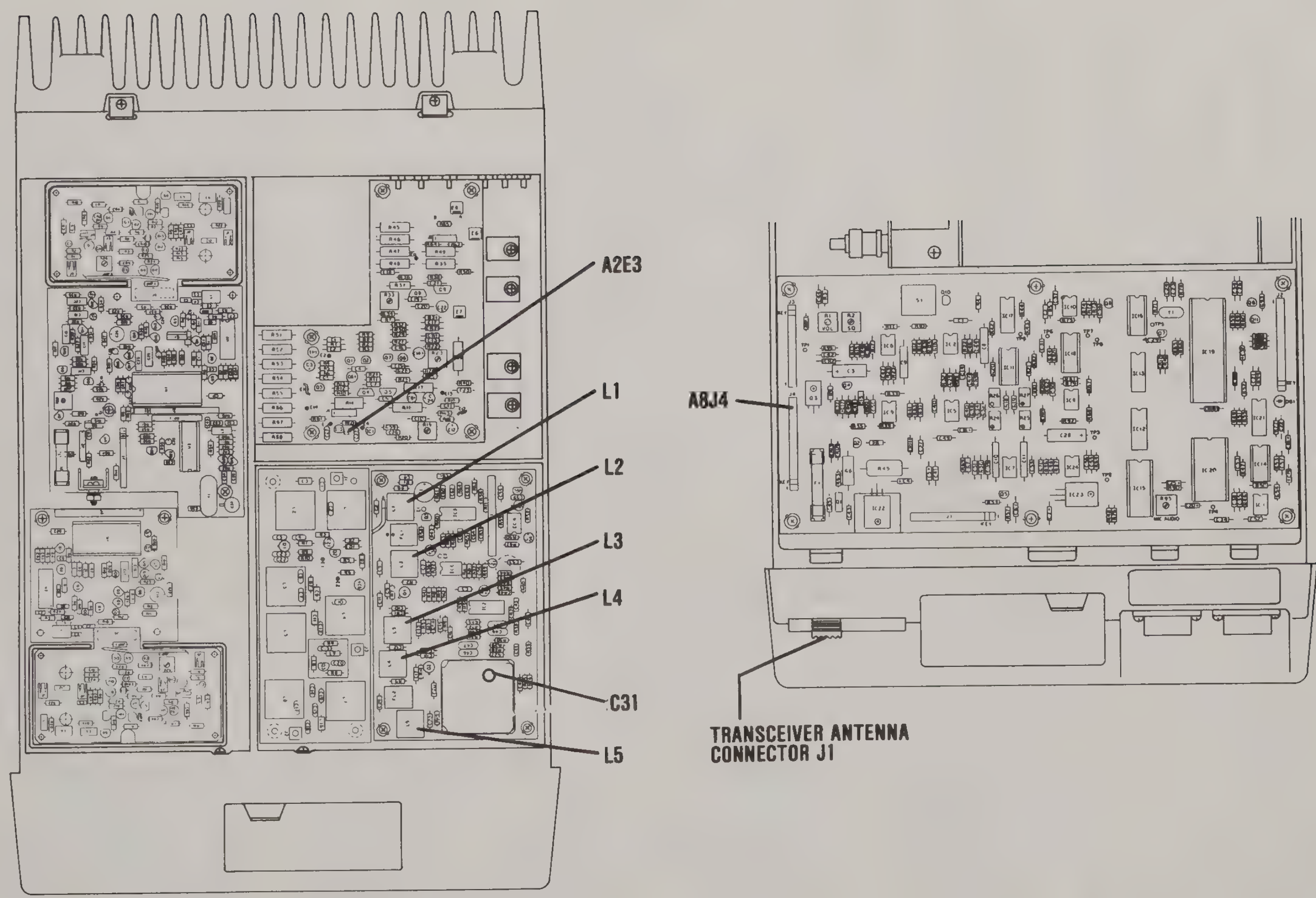
Both test points are elevated above ground by approximately six volts; therefore the dc voltmeter must be floating.

(h) Reduce signal generator deviation to ±3 KHz.

(i) Adjust C31 (accessible through hole in large shield can) to obtain a zero reading indication (±10 millivolts) on voltmeter.

(j) Remove test equipment.

(k) Reconnect Tx control line at A2E3.



NOTE

The VHF Transceiver shown above is representative of UHF as well, for marked items.

Figure 1. IF/Audio Module, Alignment, Adjustment, and Test Point Locations

6. PARTS LIST

6.01 Table 4 gives parts information for the IF/Audio Module while figure 2 gives component location information.

7. SCHEMATIC DIAGRAMS

7.01 Figure 3 is the IF/Audio Module schematic diagram with the squelch option.

7.02 Figure 4 is the IF/Audio Module schematic diagram without the squelch option.

TABLE 4

UHF/VHF IF/Audio Module, Parts List

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
A3	IF/AUDIO MOD (W/ SQUELCH)	10029-0300
A3	IF/AUDIO MOD (W/O SQUELCH)	10029-0330
C1	Capacitor, Electrolytic, 100 μF, 25V	C19-0004-101
C2	Capacitor, Ceramic, axial, 10 pF	C12-0001-013
C3	Capacitor, Ceramic, axial, 0.01 μF	C12-0001-056
C4	Capacitor, Ceramic, 0.1 μF, 50V	C-3202
C5	Capacitor, Ceramic, axial, 33 pF	C12-0001-025
C6	Not used	
C7	Capacitor, Ceramic, axial, 0.01 μF	C12-0001-056
C8	Not used	
C9	Capacitor, Ceramic, axial, 0.01 μF	C12-0001-056
C10	Capacitor, Ceramic, axial, 0.01 μF	C12-0001-056
C11	Capacitor, Ceramic, axial, 33 pF	C12-0001-025
C12	Capacitor, Ceramic, axial, 0.01 μF	C12-0001-056
C13	Capacitor, Ceramic, axial, 0.01 μF	C12-0001-056
C14	Not used	
C15	Capacitor, Ceramic, axial, 0.01 μF	C12-0001-056
C16	Capacitor, Ceramic, axial, 0.01 μF	C12-0001-056
C17	Capacitor, Ceramic, axial, 0.01 μF	C12-0001-056
C18	Capacitor, Ceramic, axial, 39 pF	C12-0001-027
C19	Capacitor, Ceramic, axial, 0.01 μF	C12-0001-056
C20	Capacitor, Ceramic, axial, 0.01 μF	C12-0001-056
C21	Capacitor, Ceramic, 0.001 μF, 500V	C-0001
C22	Not used	

NOTE: Items with * are not used in IF/Audio Module A3 without Squelch (10029-0330)

TABLE 4

UHF/VHF IF/Audio Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
C23	Capacitor, Ceramic, axial, 15 pF	C12-0001-017
C24	Capacitor, Ceramic, axial, 33 pF	C12-0001-025
C25	Capacitor, Ceramic, 0.01 μF, 50V	C-4952
C26	Capacitor, Ceramic, 0.1 F, 50V (Early Version used 0.01 uF PN C-4952 Capacitors)	C-3202
C27	Capacitor, Ceramic, 0.01 μF, 50V	C12-0001-056
C28	Not Used	
C29	Capacitor, Ceramic, 0.001 μF, 500V	C-0001
C30	Capacitor, Ceramic, axial, 0.01 μF	C12-0001-056
C31	Capacitor, Trimmer, 3–10 pF	C85-0005-072
C32	Capacitor, Ceramic, 0.01 μF, 50V	C-4952
C33	Capacitor, Ceramic, axial, 0.01 μF	C12-0001-056
C34	Not used	
C35	Not used	
C36	Capacitor, Ceramic, 0.01 μF, 50V	C-4952
C37	Not used	
C38	Capacitor, Electrolytic, 10 μF, 25V	C19-0004-100
C39	Capacitor, Ceramic, 0.1 μF, 50V	C-3202
C40	Capacitor, Ceramic, axial, 0.01μF	C12-0001-056
* C41	Capacitor, Ceramic, 0.1 μF, 50V	C-3202
C42	Capacitor, Ceramic, axial, 0.01 μF	C12-0001-056
* C43	Capacitor, Metal/Poly, 0.01 μF	10029-0951
* C44	Capacitor, Mica, 390 pF, 500V	C-0141
* C45	Capacitor, Mica, 390 pF, 500V	C-0141
* C46	Capacitor, Mica, 390 pF, 500V	C-0141

TABLE 4

UHF/VHF IF/Audio Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
* C47	Capacitor, Mica, 390 pF, 500V	C-0141
* C48	Capacitor, Ceramic, 0.1 μF, 50V	C-3202
C49	Not used	
C50	Capacitor, Tantalum, 0.47 μF, 35V	C-6419
C51	Capacitor, Tantalum, 2.2 μF, 20V	C-6444
C52	Not used	
* C53	Capacitor, Ceramic, axial, 0.01 μF	C12-0001-056
C54	Capacitor, Tantalum, 2.2 μF, 20V	C-6444
C55	Capacitor, Ceramic, axial, 33 pF	C12-0001-025
C56	Capacitor, Ceramic, axial, 100 pF	C12-0001-037
C57	Capacitor, Tantalum, 0.47 μF, 35V	C-6419
C58	Not used	
C59	Capacitor, Ceramic, 0.01 μF, 50V	C-4952
C60	Capacitor, Metal/Poly, 0.01 μF	10029-0951
C61	Capacitor, Metal/Poly, 0.0022 μF	10029-0950
C62	Capacitor, Metal/Poly, 0.01 μF	10029-0951
C63	Capacitor, Metal/Poly, 0.01 μF	10029-0951
C64	Capacitor, Metal/Poly, 0.01 μF	10029-0951
C65	Capacitor, Metal/Poly, 0.01 μF	10029-0951
CR1	Diode, Signal, 1N4454	CR-0705
* CR2	Diode, Hot Carrier, 5082-2800	CR-0403
CR3	Diode, Signal, 1N277	CR-0065
* CR4	Diode, Hot Carrier, 5082-2800	CR-0403
E1	Connector Pin	MP-0287

TABLE 4

UHF/VHF IF/Audio Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
E2	Connector Pin	MP-0287
FL1	Filter, Crystal, 21.4 MHz	10029-0325
FL2	Filter, Crystal, 21.4 MHz	G10-0001-001
FL3	Filter, Crystal, Discriminator	A01-0001-000
U1	Integrated Circuit, CA3089E	10029-0323
* U2	Integrated Circuit, CA3240E	I30-0024-000
U3	Integrated Circuit, CA324E	IC-0359
U4	Integrated Circuit, CA3080E	I31-0001-000
U5	Integrated Circuit, Voltage Regulator, MC78L08ACP	I12-0006-008
U6	Integrated Circuit, NSC LM358N	I30-0020-103
* U7	Integrated Circuit, LM358N	I30-0020-103
J1	Connector, PCB, 16-circuit	J41-0001-116
L1	Inductor, Variable	918-0239
L2	Inductor, Variable	918-0239
L3	Inductor, Variable	918-0239
L4	Inductor, Variable	918-0239
L5	Inductor, Variable	918-0239
L6	Coil, rf, molded, 3.3 μH	L-0622
L7	Coil, rf, molded, 33 μH	L-0634
L8	Coil, rf, molded, 6.8 μH	L-0626
Q1	Transistor, 40822 (Early versions were SD-306, PN Q40-0001-000)	Q40-0002-000
Q2	Transistor, 40822 (Early versions were SD-306, PN Q40-0001-000)	Q40-0002-000
Q3	Transistor, 2N4124	Q-0385
R1	Resistor, Composition, 10 ohm ± 5%, ¼ W	R-1201
R2	Resistor, Composition, 1.8 K ohm ± 5%, ¼ W	R-1255

TABLE 4

UHF/VHF IF/Audio Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
R3	Resistor, Composition, 100 K ohm ± 5%, ¼ W (Early versions were 2.2 K P/N R-1257)	R-1297
R4	Resistor, Composition, 1 K ohm ± 5%, ¼ W	R-1249
R5	Resistor, Composition, 1.8 K ohm ± 5%, ¼ W (Early versions were 2.2 K P/N R-1257)	R-1255
R6	Resistor, Composition, 2.2 K ohm ± 5%, ¼ W	R-1257
R7	Resistor, Composition, 100 ohm ± 5%, ¼ W	R-1225
R8	Resistor, Composition, 100 ohm ± 5%, ¼ W	R-1225
R9	Resistor, Composition, 100 ohm ± 5%, ¼ W	R-1225
R10	Resistor, Composition, 1.5 K ohm ± 5%, ¼ W (Early versions were 1.8 K, PN R-1255)	R-1253
R11	Resistor, Composition, 33 ohm ± 5%, ¼ W	R-1213
R12	Resistor, Composition, 27 K ohm ± 5%, ¼ W	R-1283
R13	Resistor, Composition, 3.9 K ohm ± 5%, ¼ W (Early versions were 22 K P/N R-1281)	R-1263
R14	Resistor, Composition, 100 ohm ± 5%, ¼ W	R-1225
R15	Resistor, Composition, 220 ohm ± 5%, ¼ W	R-1233
R16	Resistor, Composition, 10 ohm ± 5%, ¼ W	R-1201
R17	Resistor, Composition, 1.5 K ohm ± 5%, ¼ W	R-1253
R18	Resistor, Composition, 3.3 K ohm ± 5%, ¼ W	R-1261
R19	Resistor, Composition, 10 ohm ± 5%, ¼ W	R-1201
R20	Resistor, Composition, 1 K ohm ± 5%, ¼ W	R-1249
R21	Resistor, Composition, 33 K ohm ± 5%, ¼ W	R-1285
R22	Resistor, Composition, 150 ohm ± 5%, ¼ W	R-1229
R23	Resistor, Composition, 1 K ohm ± 5%, ¼ W	R-1249
R24	Resistor, Composition, 2.2 K ohm ± 5%, ¼ W	R-1257
R25	Resistor, Composition, 10 K ohm ± 5%, ¼ W	R-1273
R26	Resistor, Composition, 1 K ohm ± 5%, ¼ W	R-1249

TABLE 4

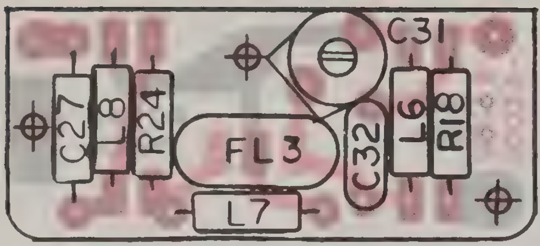
UHF/VHF IF/Audio Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
* R27	Resistor, Composition, 27 K ohm ± 5%, ¼ W	R-1283
* R28	Resistor, Composition, 39 K ohm ± 5%, ¼ W	R-1287
* R29	Resistor, Metal Film, 9090 ohm	RN55D9091F
* R30	Resistor, Metal Film, 22100 ohm	RN55D2212F
* R31	Resistor, Composition, 33 K ohm ± 5%, ¼ W	R-1285
* R32	Resistor, Metal Film, 9090 ohm	RN55D9091F
* R33	Resistor, Metal Film, 22100 ohm	RN55D2212F
* R34	Resistor, Composition, 39 K ohm ± 5%, ¼ W	R-1287
* R35	Resistor, Composition, 47 K ohm ± 5%, ¼ W	R-1289
R36	Resistor, Composition, 220 K ohm ± 5%, ¼ W	R-1233
R37	Resistor, Composition, 620 K ohm ± 5%, ¼ W	R-1316
* R38	Resistor, Composition, 43 K ohm ± 5%, ¼ W	R-1288
R39	Resistor, Composition, 1 K ohm ± 5%, ¼ W	R-1249
* R40	Resistor, Composition, 10 K ohm ± 5%, ¼ W	R-1273
* R41	Resistor, Composition, 10 K ohm ± 5%, ¼ W	R-1273
R42	Resistor, Composition, 47 ohm ± 5%, ¼ W	R-1217
* R43	Resistor, Composition, 680 K ohm ± 5%, ¼ W	R-1317
* R44	Resistor, Composition, 47 K ohm ± 5%, ¼ W	R-1289
* R45	Resistor, Composition, 56 K ohm ± 5%, ¼ W	R-1291
* R46	Resistor, Composition, 330 K ohm ± 5%, ¼ W	R-1309
* R47	Resistor, Composition, 220 K ohm ± 5%, ¼ W	R-1233
R48	Resistor, Composition 8.2K (Not Used in Early Versions)	R-1271
R49	Resistor, Composition, 10 K ohm ± 5%, ¼ W	R-1273
R50	Resistor, Composition, 100 K ohm ± 5%, ¼ W	R-1297

TABLE 4

UHF/VHF IF/Audio Module, Parts List (Cont.)

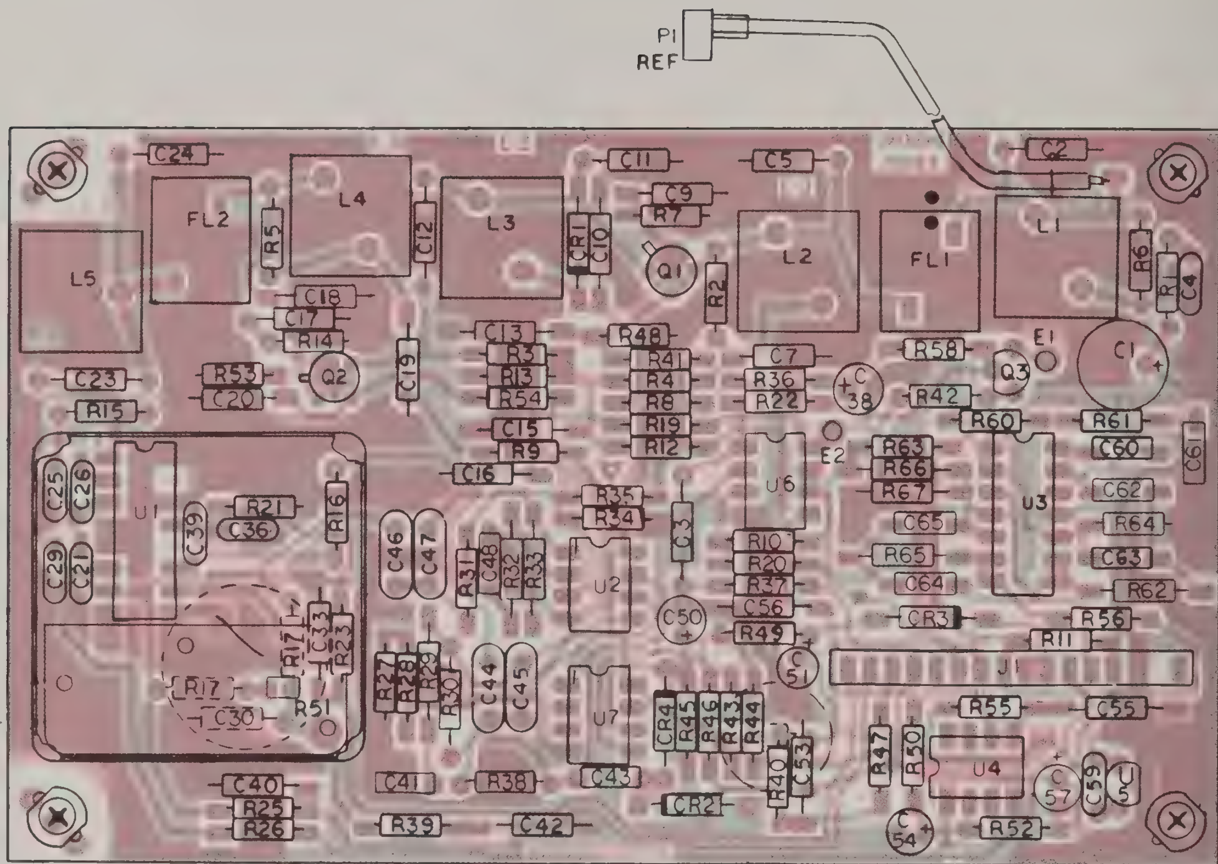
REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
* R51	Thermistor, 100 ohm	R-4261
R52	Resistor, Composition, 33 K ohm ± 5%, ¼ W	R-1285
R53	Resistor, Composition, 8.2 K (Not Used in Early Versions)	R-1271
R54	Resistor, Composition, 10 K ohm ± 5%, ¼ W	R-1273
R55	Resistor, Composition, 10 K ohm ± 5%, ¼ W	R-1273
R56	Resistor, Composition, 47 K ohm ± 5%, ¼ W	R-1289
R57	Not used	
R58	Resistor, Composition, 1.8 K ohm ± 5%, ¼ W	R-1255
R59	Not used	
R60	Resistor, Composition, 4.7 K ohm ± 5%, ¼ W	R-1265
R61	Resistor, Composition, 18 K ohm ± 5%, ¼ W	R-1279
R62	Resistor, Metal Film, 9.090 K ohm	RN55D9091F
R63	Resistor, Composition, 620K ohm ± 5%, ¼ W	R-1316
R64	Resistor, Composition, 620 K ohm ± 5%, ¼ W	R-1316
R65	Resistor, Metal Film, 22.100 K ohm	RN55D2212F
R66	Resistor, Metal Film, 97.600 K ohm	RN55D9762F
R67	Resistor, Metal Film, 80.600 K ohm	RN55D8062F
W1	COAX Assy (includes P1)	10029-0320
	Shield Can (L1-L5)	918-0237
	Shield Can (U1)	10029-0321
	Discriminator Assy	10029-0310



Discriminator Subassembly

NOTE:

- COMPONENTS SHOWN IN SOLID BLACK
- FACING SIDE FOIL SHOWN IN BLACK SCREEN
- OPPOSITE SIDE FOIL SHOWN IN RED SCREEN



Discriminator Subassembly →

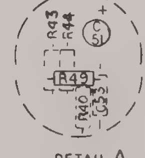
See Detail B

See Detail A

NOTES:

1. FL1 ORIENTED TO PLACE DOT TOWARD DOT ON PC BOARD.
2. PINS 8 AND 9 OF IC1 DO NOT PENETRATE BOARD. BEND 90° BEFORE INSTALLATION AND SOLDER FLAT TO PADS.
3. WIRES ITEM 9, TWO PLACES, DO NOT PENETRATE MAIN PC BOARD. SOLDER FLAT TO PADS.
4. FOR I.F. AUDIO ASSY WITHOUT SQUELCH, 10029-0330, OMIT THE FOLLOWING: C41 C44 C45 C43 C46 C47 C48 C50 C53 CR2 CR4 IC2 R27 R28 R51 R29 R30 R31 R32 R33 R34 R35 U2 R38 R43 R44 R45 R46 R47 R40 U7
5. THE DISTANCE BETWEEN THE PRINTED CIRCUIT BOARD AND THE BOTTOM OF Q1 AND Q2 TO BE .120 MAX.

DOTTED COMPONENTS SHOWN FOR LOCATION REFERENCE



DETAIL A

LOCATION OF R49 FOR 10029-0330 ASSY ONLY

DETAIL B

LOCATION OF R17 FOR 10029-0330 ASSY ONLY

Figure 2. IF/Audio Board Assembly, Component Location Diagram

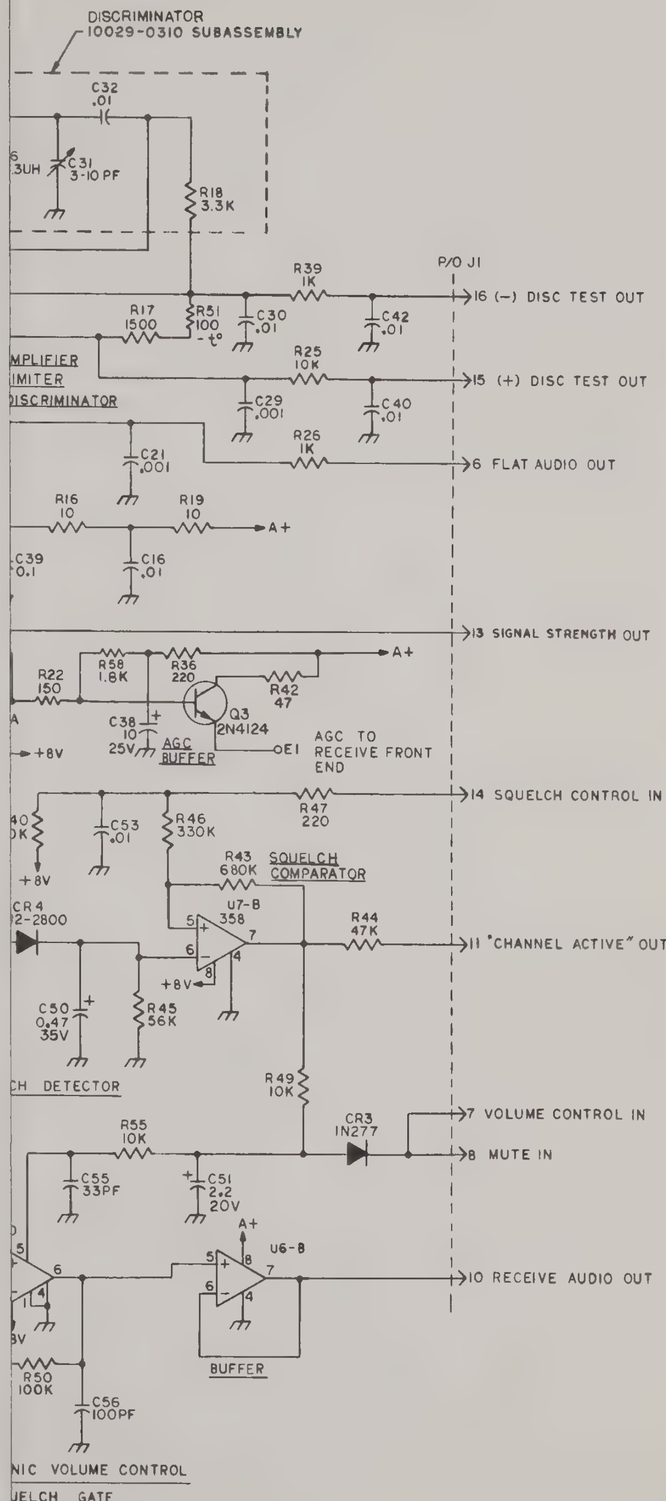
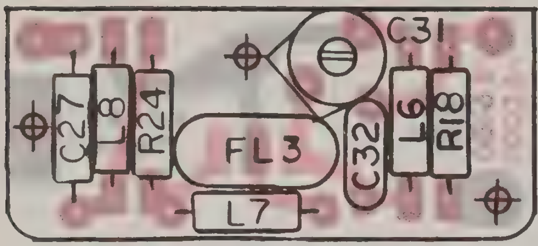
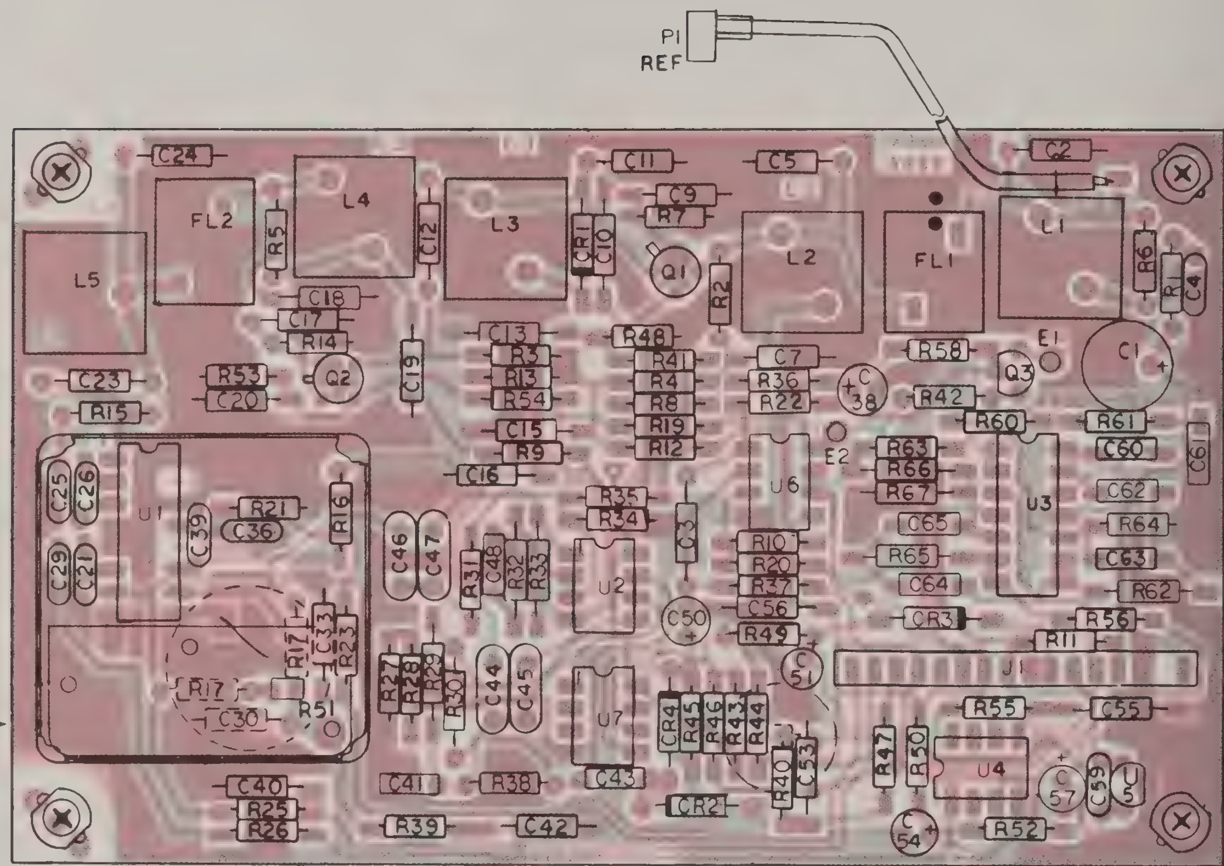


Figure 3. IF/Audio Module With Squelch, Schematic Diagram



Discriminator Subassembly

NOTE:
- COMPONENTS SHOWN IN SOLID BLACK
- FACING SIDE FOIL SHOWN IN BLACK SCREEN
- OPPOSITE SIDE FOIL SHOWN IN RED SCREEN



NCTES:
1. FL1 ORIENTED TO PLACE DOT TOWARD DOT ON PC BOARD.
2. PINS 8 AND 9 OF IC1 DO NOT PENETRATE BOARD. BEND 90° BEFORE INSTALLATION AND SOLDER FLAT TO PADS.
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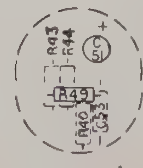
4. FOR I.F. AUDIO ASSY WITHOUT SQUELCH, 10029-0330, OMIT THE FOLLOWING: C41 C44 C45 C43 C46 C47 C48 C50 C53 CR2 CR4 IC2 R27 R28 R51 R29 R30 R31 R32 R33 R34 R35 U2 R38 R43 R44 R45 R46 R47 R40 U7
5. THE DISTANCE BETWEEN THE PRINTED CIRCUIT BOARD AND THE BOTTOM OF Q1 AND Q2 TO BE .120 MAX.

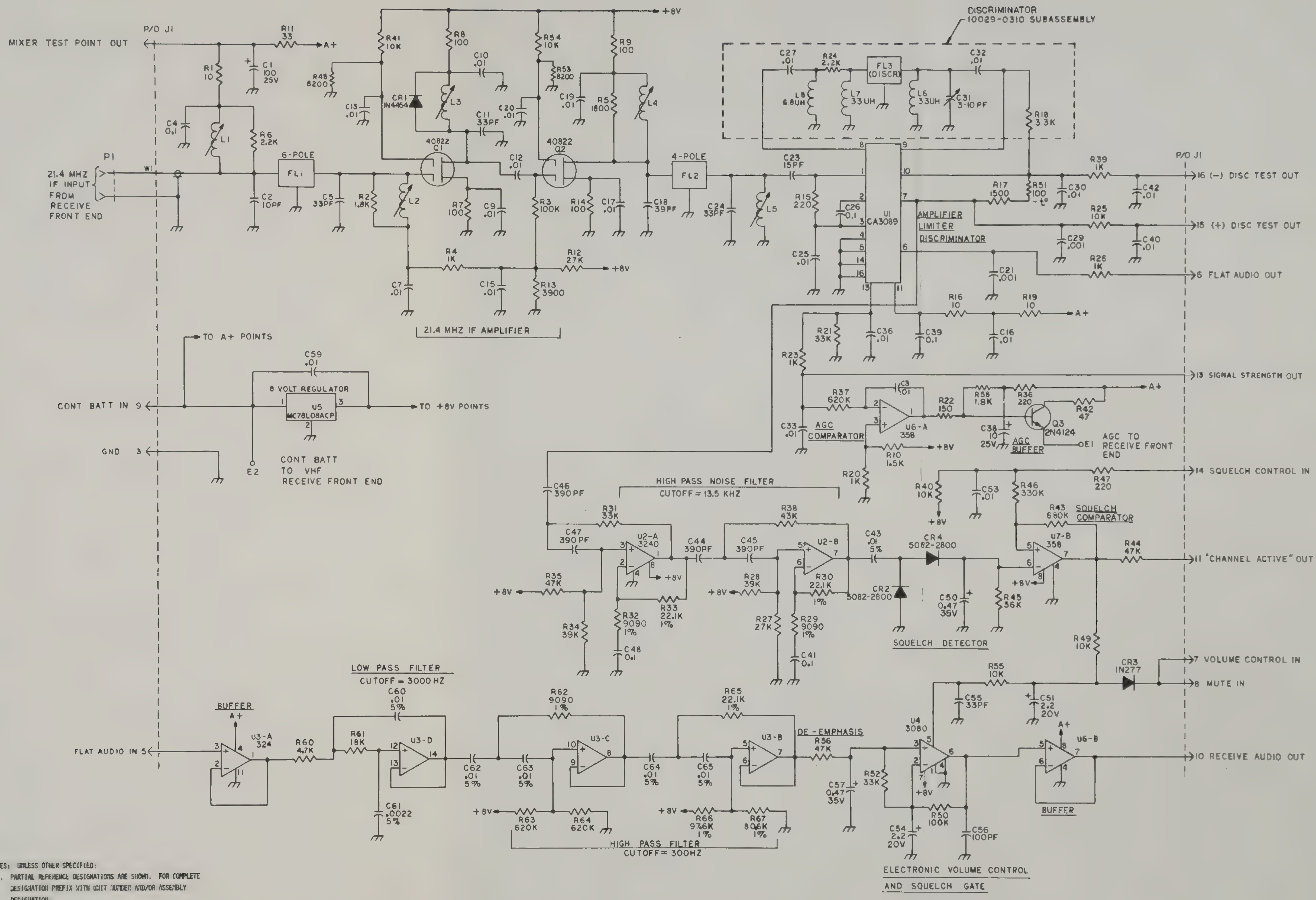
DOTTED COMPONENTS SHOWN FOR LOCATION REFERENCE



DETAIL A
LOCATION OF R49 FOR 10029-0330 ASSY ONLY

DETAIL B
LOCATION OF R17 FOR 10029-0330 ASSY ONLY

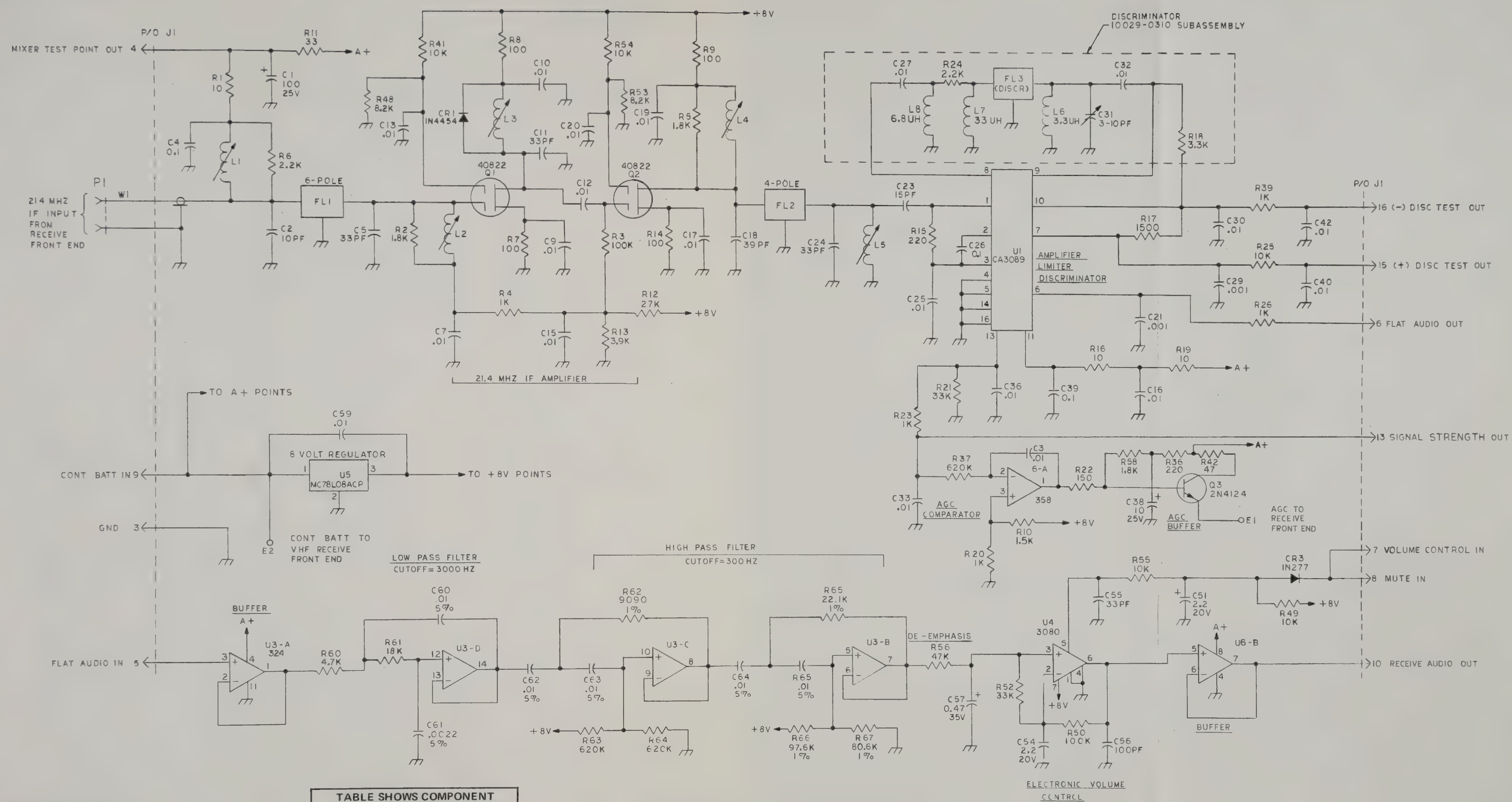
Figure 2. IF/Audio Board Assembly, Component Location Diagram



NOTES: UNLESS OTHER SPECIFIED:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER AND/OR ASSEMBLY DESIGNATION.
2. RESISTOR VALUES ARE IN OHMS, 1/4W, 5%
3. CAPACITOR VALUES ARE IN UF.
4. VENDOR AND/OR JEDEC PART NUMBER CALLOUTS ARE FOR REFERENCE ONLY; COMPONENTS ARE SUPPLIED PER PART NUMBER IN PARTS LIST.

Figure 3. IF/Audio Module With Squelch, Schematic Diagram



NOTES: UNLESS OTHERWISE SPECIFIED:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER AND/OR ASSEMBLY DESIGNATION.
2. RESISTOR VALUES ARE IN OHMS, 1/4 W, 5%
3. CAPACITOR VALUES ARE IN UF.
4. VENDOR AND/OR JEDEC PART NUMBER CALLOUTS ARE FOR REFERENCE ONLY; COMPONENTS ARE SUPPLIED PER PART NUMBER IN PARTS LIST.

TABLE SHOWS COMPONENT CHANGES BETWEEN EARLY AND LATE VERSIONS.

Component Designation	Early Value	Late Value
C26	.01	.1
Q1,2	SD306	40822
R3	2.2K	100K
R5	2.2K	1.8K
R10	1.8K	1.5K
R13	22K	3.9K
R48	not used	8.2K
R53	not used	8.2K

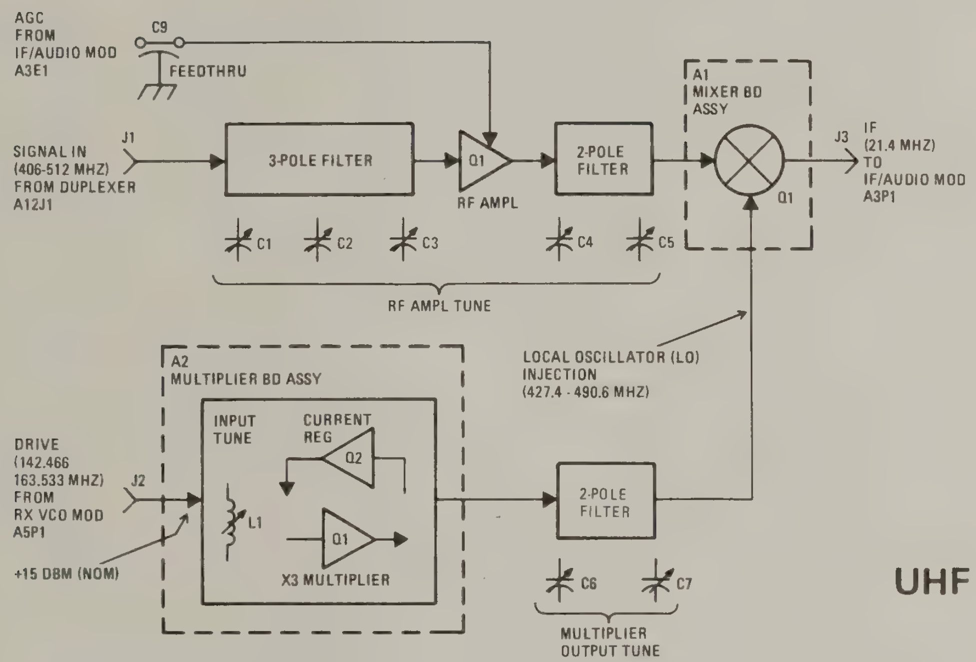
HIGHEST REFERENCE DESIGNATION					
J1	P1	R67	C65	FL 3	CR 3
L8	Q3	U6			
REFERENCE DESIGNATIONS NOT USED					
CR 2	U2	R40	R43-47		R51
	R57	R59	C28	C6	C8
C14	C22	C34	C35	C37	C41
C43-50	C52	C53	C56	R27-35	R38

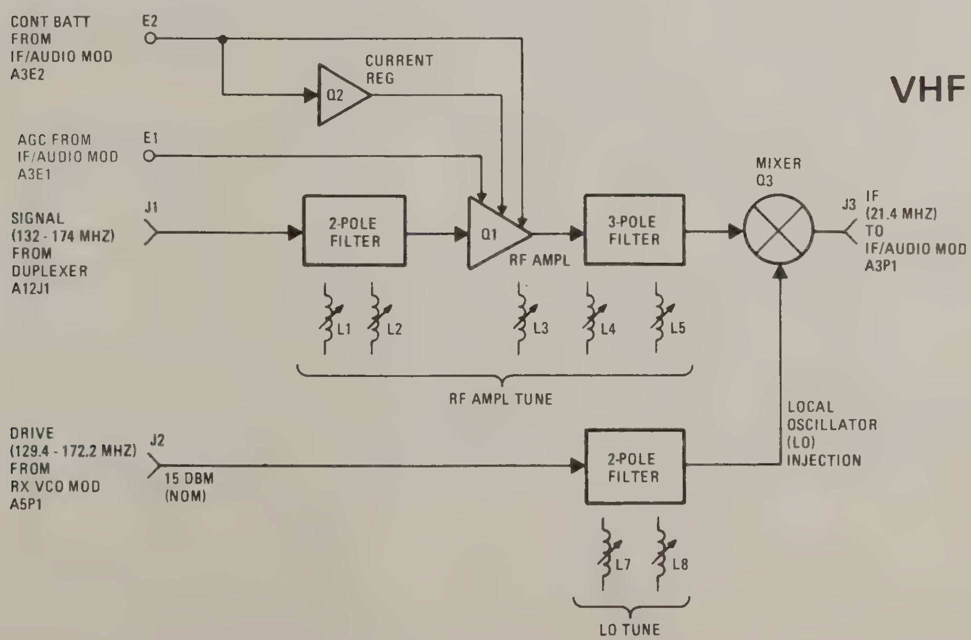
Figure 4. IF/Audio Module Without Squelch, Schematic Diagram

A4

RX FRT END MOD

VHF 132.0 to 150.8 MHz = 10029-2410
150.8 to 174.0 MHz = 10029-2400
UHF 406 to 512 MHz = 10029-1400





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LIST OF TABLES

1. GENERAL DESCRIPTION

1.01 The major functions of UHF and VHF Receiver Front End Module A4 are shown on the tab section cover diagram. The Receiver Front End Module converts the received UHF or VHF signal to 21.4 MHz for further processing in IF/Audio Module A3.

1.02 The UHF Receiver Front End Module contains a preselection filter, a gain controlled amplifier, and an interstage filter in the rf signal path. VCO drive is applied to a frequency tripler and filter to provide local oscillator injection. The rf signal and the local oscillator signal are mixed, resulting in a 21.4 MHz output for the IF/Audio Module.

1.03 The VHF Receiver Front End Module functions in the same manner except a tripler is not required. VCO drive is simply filtered, and then injected directly.

2. INTERFACE CONNECTIONS

2.01 Interface connections for the UHF and VHF Receiver Front End Modules are shown in tables 1A and 1B.

TABLE 1A

UHF Receiver Front End Interface Connections

REF DESIG	FUNCTION	TO/FROM	
J1	SIGNAL IN	—	A12J1
J2	RX VCO IN	—	A5P1
J3	21.4 MHz IF OUT	A3P1	—
C9	AGC IN	—	A3E1

TABLE 1B

VHF Receiver Front End Interface Connections

REF DESIG	FUNCTION	TO/FROM	
J1	SIGNAL IN	—	A12P1
J2	RX VCO IN	—	A5P1
J3	21.4 MHz IF OUT	A3P1	—
E1	AGC IN	—	A3E1
E2	CONT BATT IN	—	A3E2

3. SUPPLEMENTARY SEMICONDUCTOR DATA

3.01 Transistor lead identification diagrams will be found in Chapter 4, Maintenance of this manual.

4. TECHNICAL DESCRIPTION

A. UHF Receiver Front End Module Description

4.01 Details of the UHF Receiver Front End Module appear in figure 5. The majority of the components are located on Mixer Board Assembly A1 and Multiplier Board Assembly A2. These boards, and the remaining components, are mounted inside the cover of the Receiver Front End Module. The module base provides shielding, and controlled coupling between filter elements through internal apertures. The three filters are comb-line type, and provide high harmonic rejection. All circuits can be adjusted over a signal frequency range of 406 to 512 MHz without any component changes.

4.02 The rf signal enters the Receiver Front End Module at J1 and passes through the three-pole preselection filter (coils L1–L3, capacitors C1–C3) to J-FET amplifier Q1. The gain of this stage is controlled by variation of its drain supply voltage (AGC) which enters the Receiver Front End Module from the IF/Audio Module via feedthrough capacitor C9. The output of Q1 passes through a two-pole interstage filter to Mixer Board Assembly A1.

4.03 The Rx VCO output signal (nominal +15 dBm) enters the Receive Front End Module at J2, superimposed upon a +9.5 dc voltage. The latter is the dc supply for operation of Multiplier Board Assembly A2. It is separated from the VCO signal by coil A2L2 and capacitor A2C7, and blocked from transistor A2Q1 base circuit by capacitor A2C4. The VCO signal is applied to the base of A2Q1 through pi-matching circuit coil A2L1, capacitor A2C1, and capacitor A2C2 which is tuned to the VCO frequency.

4.04 Transistor A2Q1 operates without forward bias, being driven on only by the VCO signal. Therefore, it operates in a nonlinear fashion with an output high in harmonics. Two-pole filter coils L6-L7, capacitors C6-C7 rejects all harmonics except the third, as well as the fundamental VCO frequency. The desired third harmonic is applied as the LO injection to Mixer Board Assembly A1.

4.05 The collector current of transistor A2Q1 can be monitored by observing the

voltage drop across resistor A2R4. This drop acts to turn on transistor A2Q2, drawing current through pin diode shunt attenuator A2CR1. The drive signal to A2Q1, and thus its collector current, are reduced by this action. The loop is self-stabilizing, with a resultant collector current of 35 to 40 ma.

4.06 The amplified and filtered rf signal, and the LO injection signal, are combined in J-FET Mixer A1Q1 to produce a 21.4 MHz IF output at J3. The dc drain supply for A1Q1 is received via the coax interconnecting cable from IF/Audio Module.

4.07 In the range of 406 to 450 MHz received signal frequency, high side injection (LO is 21.4 MHz above signal) is employed. From 450 to 512 MHz, the injection is on the low side. VCO frequency can be computed:

For signal between 406 and 450 MHz,

$$VCO = \frac{F\ (signal)\ + 21.4\ MHz}{3}$$

For signal between 450 and 512 MHz,

$$VCO = \frac{F\ (signal)\ - 21.4\ MHz}{3}$$

B. VHF Receiver Front End Module Description

4.08 The VHF incoming rf signal (132 to 174 MHz) passes from Duplexer Module A12 to the Receiver input J1 of the Receiver Front End Module. This Receiver input signal is passed through a tunable two-pole LC filter before amplification by gain controlled rf amplifier Q1. The AGC signal controlling the gain is produced in IF/Audio Module A3 and is applied to Gate 2 of Q1 via E1 connector. Transistor Q2 compares the voltage drop across resistor R5 (due to the current in Q1) with the drop in diode CR2. It then adjusts the voltage at Gate 1 to keep both equal. This provides Q1 with approximately 12 ma drain current. The rf signal is then coupled through a tunable three-pole LC filter to the Gate of mixer Q3.

4.09 The output of the Rx VCO Module in the range of 129.4 to 172.2 MHz is coupled through connector J2 and a tunable two-pole LC filter to the source of mixer Q3. Mixing of the VCO signal with the rf signal (present at the gate) produces an IF output signal of 21.4 MHz which is applied to the input of the IF/Audio Module through J3. The dc drain supply for Q3 is received via the coax interconnecting cable from the IF/Audio Module.

4.10 In the range of 132 to 150.8 MHz (received signal frequency) high side injection (LO is 21.4 MHz above signal) is employed. From 150.8 to 174 MHz, injection is on the low side. VCO frequency can be computed:

For signal between 132 and 150.8 MHz,

$$VCO = f\ (signal)\ + 21.4\ MHz$$

For signal between 150.8 and 174 MHz,

$$VCO = f\ (signal)\ - 21.4\ MHz$$

5. MAINTENANCE

A. General Information

5.01 The adjustments indicated by alignment procedures described in this section are made at the factory prior to shipment. Normally, it is not necessary to repeat any of these adjustments unless there is a component failure or a change in operating frequency is being made.

5.02 If a substantial change in the operating frequency is being made, steps (c) and (i) in the following procedure may not initially be possible. If so, perform an initial alignment by listening to the output of the Transceiver while tuning the Receiver Front End Module for best sensitivity. Then perform normal alignment steps in accordance with the procedure.

5.03 Alignment of the Receiver Front End Module should be performed only when operating with the IF/Audio Module, which acts as both load and dc power source for the mixer. Alignment procedures below assume that work is being performed in a complete Transceiver, with the control unit and adequate power supply connected.

NOTE

The IF/Audio Module should not be readjusted during this procedure. Correct procedure for readjustment of the IF/ Audio Module is contained in tab section A3.

B. UHF Receiver Front End Module Alignment

5.04 Refer to figure 1 for adjustment and test point locations.

(a) Using Control Unit, select center channel.

(b) Connect dc voltmeter between Cont Batt test point A8J4-4 (+) and mixer test point A8J4-15 (−).

NOTE

Both test points are elevated above ground potential by approximately 14 volts; therefore the dc voltmeter must be floating.

(c) Adjust inductor A2L1 and trimmers C6 and C7 for maximum voltmeter indication. The indication should be between 0.13 and 0.22 Vdc.

NOTE

With no LO injection (adjustments far off, or VCO signal disconnected from J2) a residual indication of 0.08 to 0.16 Vdc should be observed. This is due to the basic self-biased current of the mixer. An increase of 0.03 to 0.06 volts should then occur when proper LO injection is applied.

(d) Disconnect dc voltmeter.

(e) Disconnect Tx control line at A2E3 to disable Transmitter.

(f) If Receiver contains IF/Audio Module with squelch option (PN 10029-0300), rotate squelch control R2 on Interface Logic Module fully clockwise, to open squelch gate.

(g) Connect FM signal generator to Transceiver antenna connector J1. Set generator to selected channel frequency, with modulation at 1000 Hz and ±3 kHz deviation.

(h) Connect dc voltmeter between Signal Strength test point A8J4-16 (+) and Ground test point A8J4-1 (−).

(i) Adjust FM signal generator output level for 4.0 to 4.2 Vdc indication on voltmeter.

(j) Adjust trimmers C1 through C5 for maximum indication. Do not readjust C6, C7, or A2L1. If necessary, readjust generator output level to maintain 4.0 to 4.2 Vdc indication.

(k) Disconnect dc voltmeter.

(l) Connect sinad meter between Rcv Audio test point A8J4-6 and Ground test point A8J4-1.

(m) Adjust FM signal generator output level for 12 dB sinad indication.

(n) Make fine adjustment to trimmers C1 through C5 for maximum sinad indication. Reduce generator output level when necessary, to keep indication at approximately 12 dB. Do not readjust C6, C7 or A2L1.

(o) If Receiver is equipped with squelch, increase generator output level until desired squelch opening sinad indication is obtained (approximately 15 to 20 dB).

(p) Rotate A8R2 counterclockwise until squelch closes, then clockwise until audio output just returns.

(q) Remove test equipment.

(r) Reconnect Tx control line to A2E3.

C. VHF Receiver Front End Module Alignment

5.05 Refer to figure 1 for adjustment and test point locations.

(a) Using Control Unit, select center channel.

(b) Connect dc voltmeter between Cont Batt test point A8J4-4 (+) and Mixer test point A8J4-15 (−).

NOTE

Both test points are elevated above ground potential by approximately 14 volts; therefore the dc voltmeter must be floating.

(c) Using a NONMETALLIC tuning tool, adjust inductors L7 and L8 for maximum voltmeter indication. The indication should be between 0.13 and 0.22 Vdc. See note after paragraph 5.04 (c).

(d) Disconnect dc voltmeter.

(e) Disconnect Tx Control Line at A2E3 to disable Transmitter.

(f) If the Receiver contains the IF/Audio Module with squelch option (P/N 10029-0300) rotate squelch control R2 on Interface Logic Module fully clockwise to open squelch gate.

(g) Connect FM signal generator to antenna connector J1. Set generator to selected channel frequency with modulation at 1000 Hz and a ± 3 KHz deviation.

(h) Connect dc voltmeter between Signal Strength test point A8J4-16 (+) and Ground test point A8J4-1(−).

(i) Adjust FM signal generator output level until 4.0 to 4.2 Vdc indication is obtained on dc voltmeter.

(j) Using a NONMETALLIC tuning tool, adjust inductors L1 through L5 for maximum indication on dc voltmeter. **DO NOT ADJUST L7 OR L8.** If necessary, readjust generator output level to maintain 4.0 to 4.2 Vdc indication.

(k) Disconnect dc voltmeter.

(l) Connect sinad meter between Rcv Audio test point A8J4-6 and Ground test point A8J4-1.

(m) Adjust FM signal generator output level for 12 dB sinad indication.

(n) Make fine adjustment to inductors L1 through L5 for maximum sinad indication. Reduce generator output level when necessary to keep indication approximately 12 dB. **DO NOT READJUST L7 or L8.**

(o) If Receiver is equipped with squelch, increase generator output level until desired squelch opening sinad indication is obtained (approximately 15 to 20).

(p) Rotate A8R2 counterclockwise until squelch closes, then clockwise until audio output just returns.

(q) Remove test equipment.

(r) Reconnect Tx control line to A2E3.

6. PARTS LIST

A. UHF Receiver Front End Module

6.01 Table 2 lists the parts in the UHF Receiver Front End Module. Table 3 lists the parts for UHF Mixer Board Assembly A1. Table 4 lists the parts for UHF Multiplier Board Assembly A2.

6.02 Figure 2 gives component location information for the UHF Receiver Front End Module. Figure 3 gives component location information for UHF Mixer Board Assembly A1. Figure 4 gives component location information for UHF Multiplier Board Assembly A2.

B. VHF Receiver Front End Module

6.03 Table 5 lists the parts in the VHF Receiver Front End Module. Figure 6 gives component location information for the VHF Receiver Front End Module.

7. SCHEMATIC DIAGRAMS

A. UHF Receiver Front End Module

7.01 Figure 5 is the schematic diagram applicable to the UHF Receiver Front End Module.

B. VHF Receiver Front End Module

7.02 Figure 7 is the schematic diagram applicable to the VHF Receiver Front End Module.

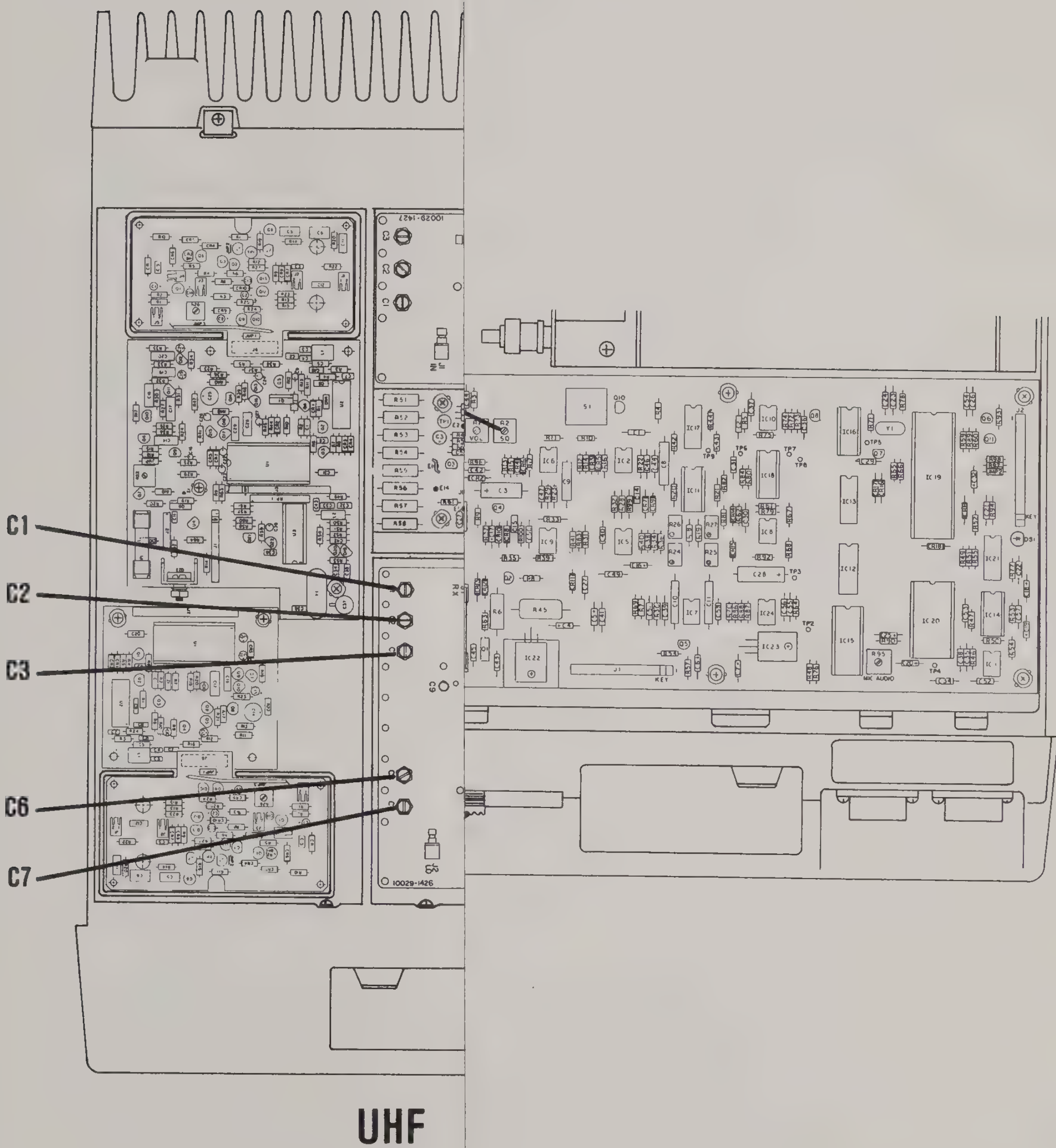

Figure 1. Receiver Front End Module Alignment, Adjustment, and Test Point Locations

(d) Disconnect dc voltmeter.

(e) Disconnect Tx Control Line at A2E3 to disable Transmitter.

(f) If the Receiver contains the IF/Audio Module with squelch option (P/N 10029-0300) rotate squelch control R2 on Interface Logic Module fully clockwise to open squelch gate.

(g) Connect FM signal generator to antenna connector J1. Set generator to selected channel frequency with modulation at 1000 Hz and a ±3 KHz deviation.

(h) Connect dc voltmeter between Signal Strength test point A8J4-16 (+) and Ground test point A8J4-1(−).

(i) Adjust FM signal generator output level until 4.0 to 4.2 Vdc indication is obtained on dc voltmeter.

(j) Using a NONMETALLIC tuning tool, adjust inductors L1 through L5 for maximum indication on dc voltmeter. **DO NOT ADJUST L7 OR L8.** If necessary, readjust generator output level to maintain 4.0 to 4.2 Vdc indication.

(k) Disconnect dc voltmeter.

(l) Connect sinad meter between Rcv Audio test point A8J4-6 and Ground test point A8J4-1.

(m) Adjust FM signal generator output level for 12 dB sinad indication.

(n) Make fine adjustment to inductors L1 through L5 for maximum sinad indication. Reduce generator output level when necessary to keep indication approximately 12 dB. **DO NOT READJUST L7 or L8.**

(o) If Receiver is equipped with squelch, increase generator output level until desired squelch opening sinad indication is obtained (approximately 15 to 20).

(p) Rotate A8R2 counterclockwise until squelch closes, then clockwise until audio output just returns.

(q) Remove test equipment.

(r) Reconnect Tx control line to A2E3.

6. PARTS LIST

A. UHF Receiver Front End Module

6.01 Table 2 lists the parts in the UHF Receiver Front End Module. Table 3 lists the parts for UHF Mixer Board Assembly A1. Table 4 lists the parts for UHF Multiplier Board Assembly A2.

6.02 Figure 2 gives component location information for the UHF Receiver Front End Module. Figure 3 gives component location information for UHF Mixer Board Assembly A1. Figure 4 gives component location information for UHF Multiplier Board Assembly A2.

B. VHF Receiver Front End Module

6.03 Table 5 lists the parts in the VHF Receiver Front End Module. Figure 6 gives component location information for the VHF Receiver Front End Module.

7. SCHEMATIC DIAGRAMS

A. UHF Receiver Front End Module

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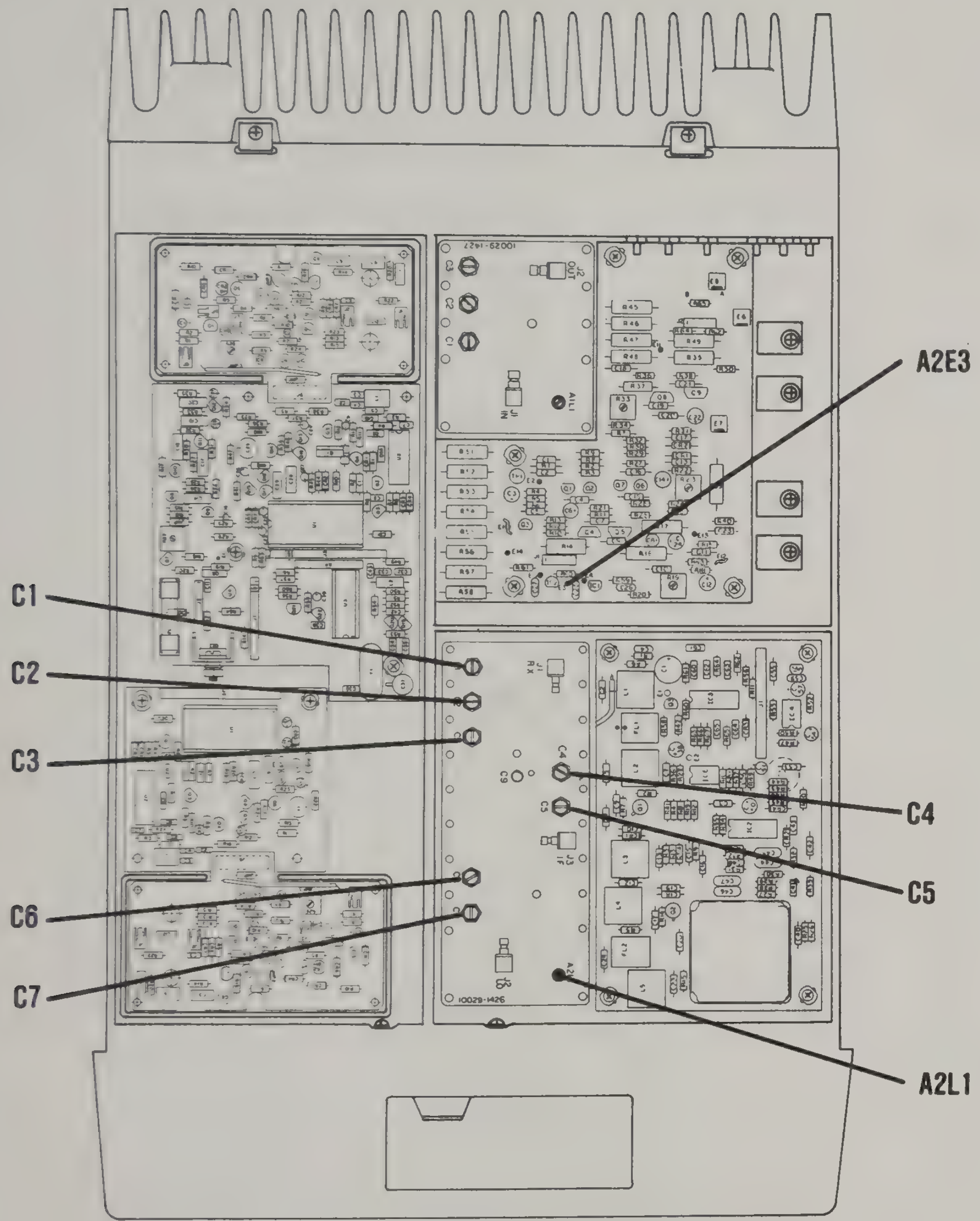
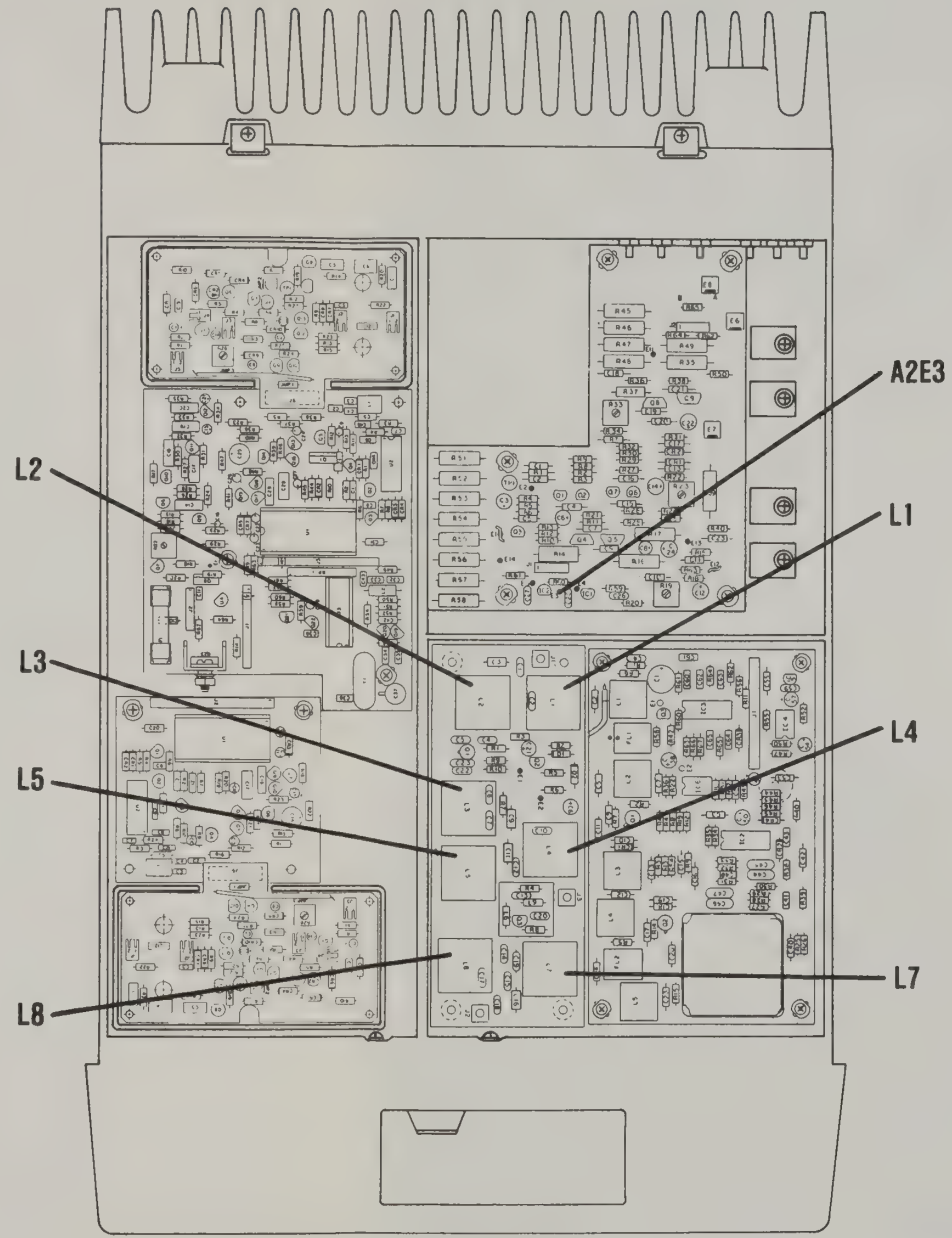
B. VHF Receiver Front End Module

7.02 Figure 7 is the schematic diagram applicable to the VHF Receiver Front End Module.



UHF



VHF

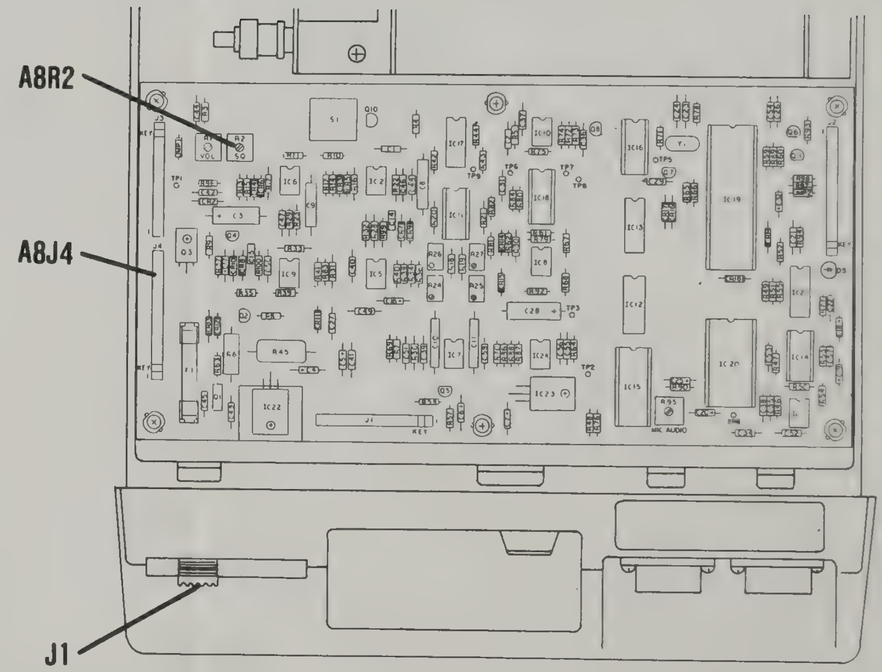


Figure 1. Receiver Front End Module Alignment, Adjustment, and Test Point Locations

TABLE 2

UHF Receiver Front End Module, Parts List

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
A4	UHF RX FRT END	10029-1400
	COVER ASSEMBLY	10029-1420
C1	Capacitor, Variable, 1-10 pF	C-2178
C2	Capacitor, Variable, 1-10 pF	C-2178
C3	Capacitor, Variable, 1-10 pF	C-2178
C4	Capacitor, Variable, 1-10 pF	C-2178
C5	Capacitor, Variable, 1-10 pF	C-2178
C6	Capacitor, Variable, 1-10 pF	C-2178
C7	Capacitor, Variable, 1-10 pF	C-2178
C8	Capacitor, Ceramic, axial, 0.01 μF	C12-0001-056
C9	Capacitor, Feed-thru, 1000 pF	C05-0003-102
J1	Jack, Coax, PCB mount	J-0086
J2	Jack, Coax, PCB mount	J-0086
J3	Jack, Coax, PCB mount	J-0086
L1	Tuning Rod	10029-1417
L2	Tuning Rod	10029-1417
L3	Tuning Rod	10029-1417
L4	Tuning Rod	10029-1417
L5	Tuning Rod	10029-1417
L6	Tuning Rod	10029-1417
L7	Tuning Rod	10029-1417
L8	Coil, rf, molded, 0.47 μH	L-0612
Q1	Transistor, 2N4416	Q-0365

TABLE 3

UHF Mixer Board Assembly A1, Parts List

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
A4A1	MIXER BOARD ASSY	10029-1430
C1	Capacitor, NPO Temp. Comp., 15 pF	C-6814
C2	Capacitor, Ceramic, 0.01 μF, 200V	C-3200
C3	Capacitor, NPO Temp. Comp., 15 pF	C-6814
C4	Capacitor, Ceramic, 0.01 μF, 200V	C-3200
L1	Choke, molded, 0.022 μH	L05-0001-002
L2	Coil, rf, molded, 0.15 μH	L-0606
Q1	Transistor, J-310	Q35-0001-001
R1	Resistor, Composition, 560 ohm ± 5%, 1/8 W	RCR05G561JM

TABLE 4

UHF Multiplier Board Assembly A2, Parts List

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
A4A2	RX MULTR BD ASSY	10029-1720
C1	Capacitor, UNELCO, 10 pF	C45-0001-100
C2	Capacitor, Ceramic, 27 pF	C-6819
C3	Capacitor, Ceramic, 100 pF	C-6830
C4	Capacitor, Ceramic, 100 pF	C-6830
C5	Capacitor, UNELCO, 47 pF	C45-0001-470
C6	Capacitor, Ceramic, 0.1 μF, 50V	C11-0005-104
C7	Capacitor, Ceramic, 0.1 μF, 50V	C11-0005-104
CR1	Diode, PIN	919-1261
CR2	Diode, Signal, 1N4454	CR-0705
L1	Inductor, Variable	10029-1730
L2	Coil, rf, molded, 3.3 μH	L-0622
L3	Coil, rf, molded, 0.47 μH	L-0612
Q1	Transistor, BFR96	10029-0991
Q2	Transistor, 2N4126	Q-0386
R1	Resistor, Composition, 1 K ohm ± 5%, ⅛W	RCR05G102JM
R2	Resistor, Composition, 3.3 K ohm ± 5%, ⅛W	RCR05G332JM
R3	Resistor, Composition, 1.5 K ohm ± 5%, ⅛W	RCR05G152JM
R4	Resistor, Composition, 15 ohm ± 5%, ¼W	RCR07G150JM
R5	Resistor, Composition, 22 ohm ± 5%, ⅛W	RCR05G220JM

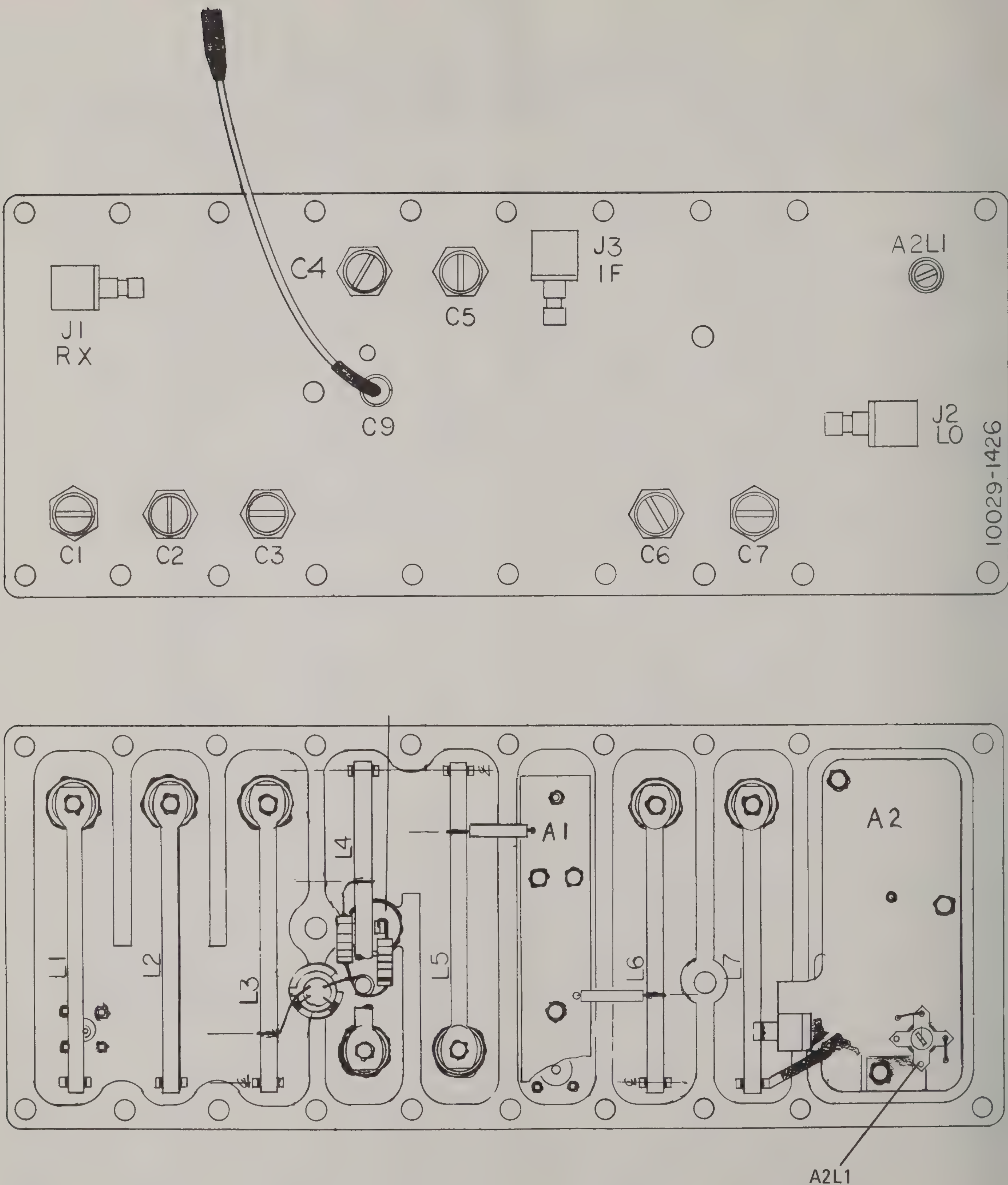


Figure 2. UHF Receiver Front End Module, Component Location Diagram

NOTE:
- COMPONENTS SHOWN IN SOLID BLACK
- FACING SIDE FOIL SHOWN IN BLACK SCREEN
- OPPOSITE SIDE FOIL SHOWN IN RED SCREEN

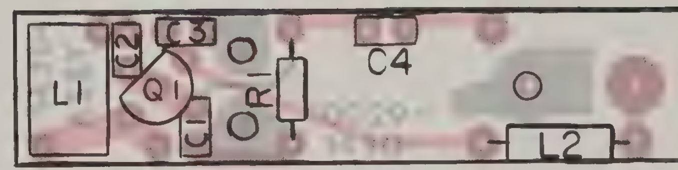


Figure 3. UHF Mixer Board Assembly A1, Component Location Diagram

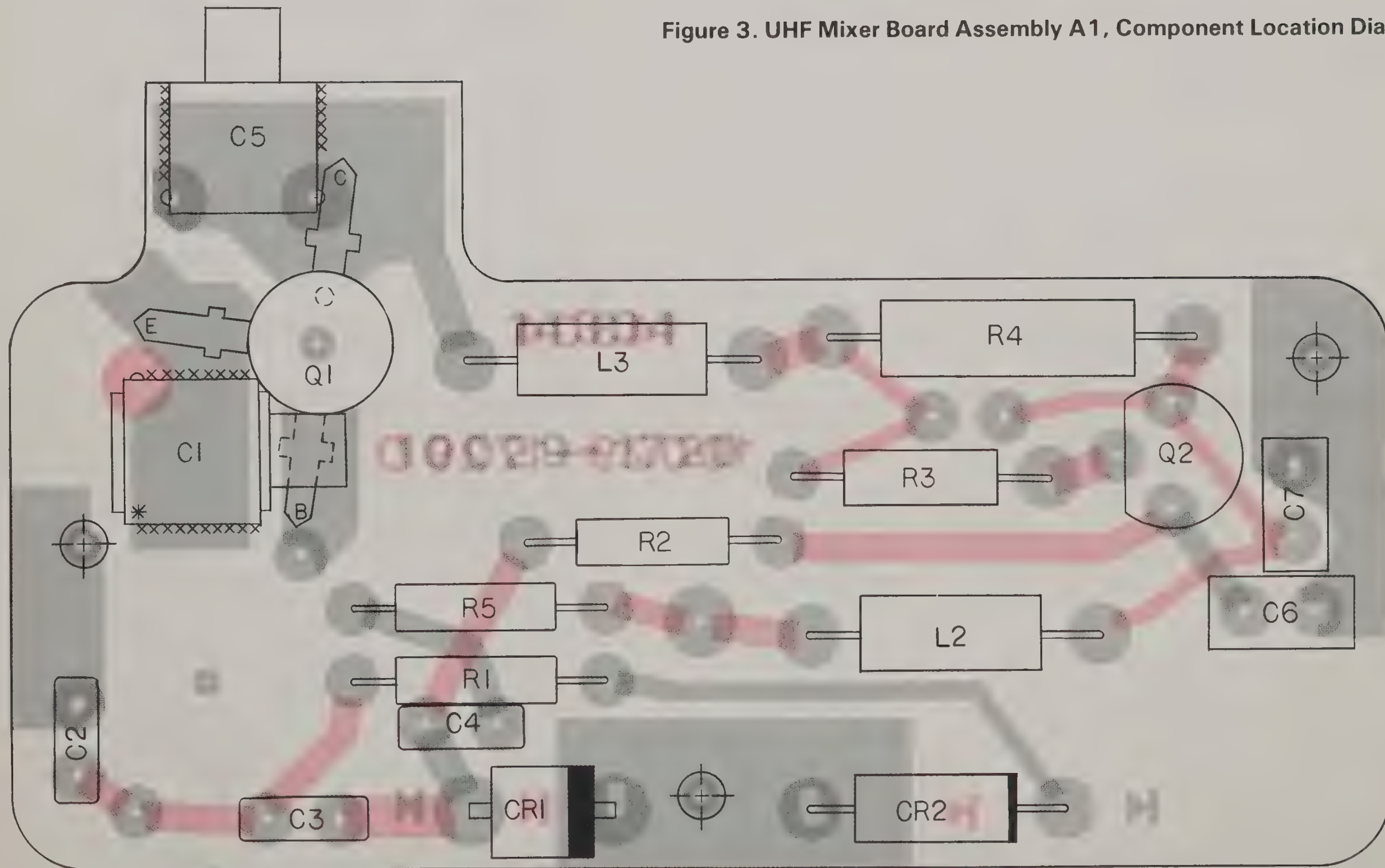


Figure 4. UHF Multiplier Board A2, Component Location Diagram

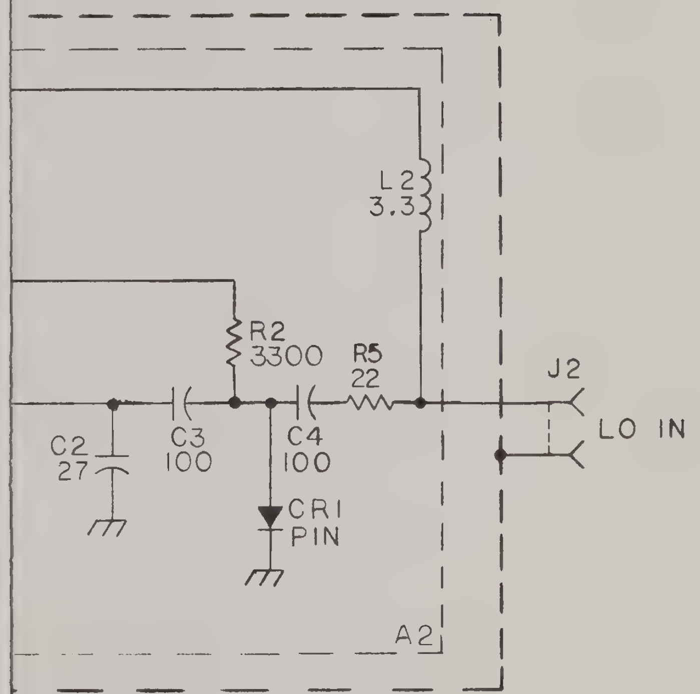


Figure 5. UHF Receiver Front End Module, Schematic Diagram

NOTE:
- COMPONENTS SHOWN IN SOLID BLACK
- FACING SIDE FOIL SHOWN IN BLACK SCREEN
- OPPOSITE SIDE FOIL SHOWN IN RED SCREEN

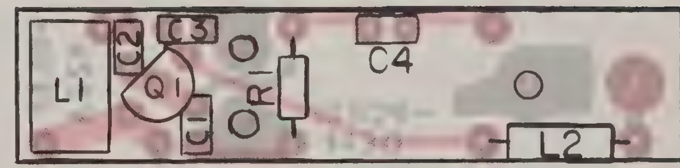


Figure 3. UHF Mixer Board Assembly A1, Component Location Diagram

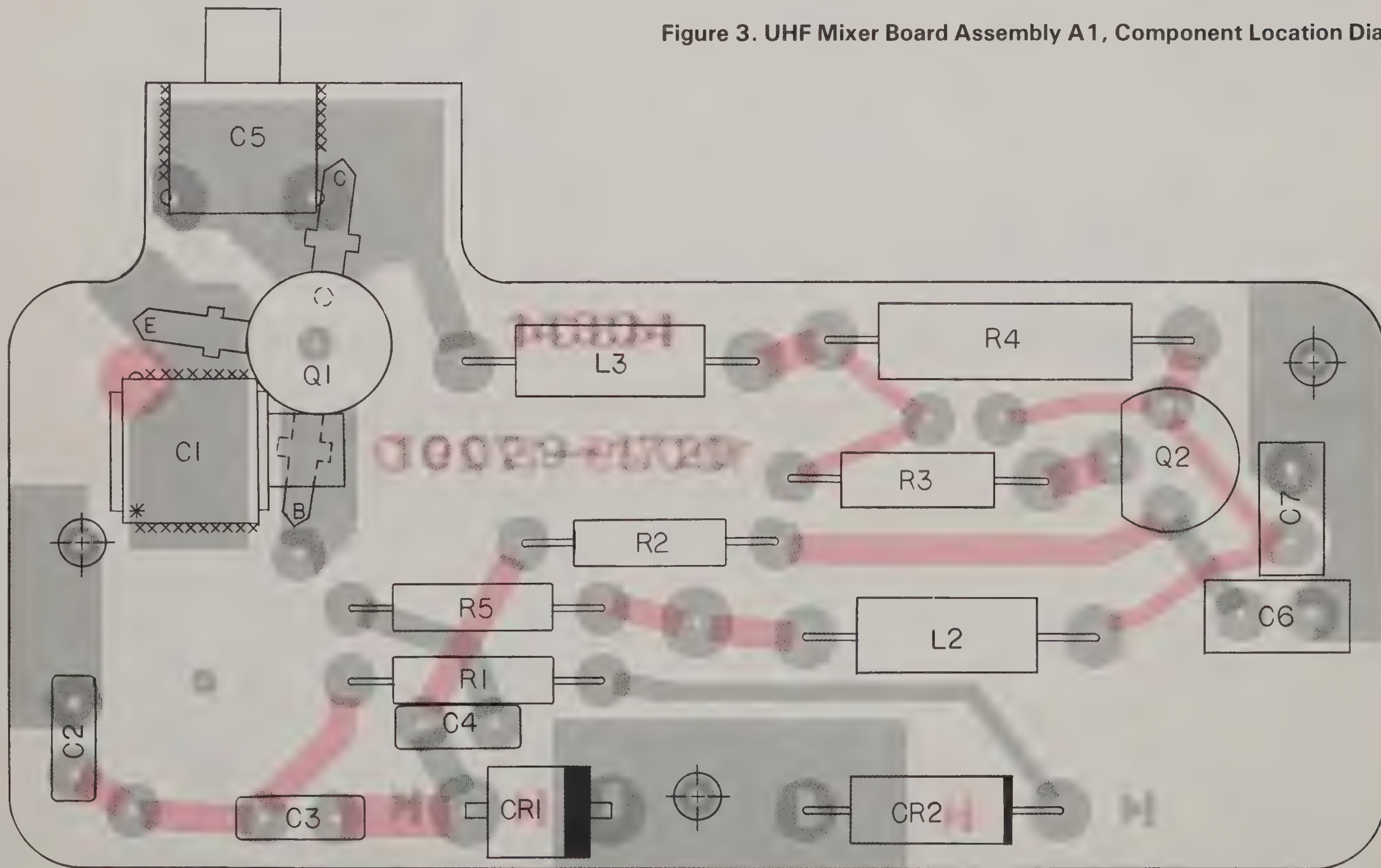
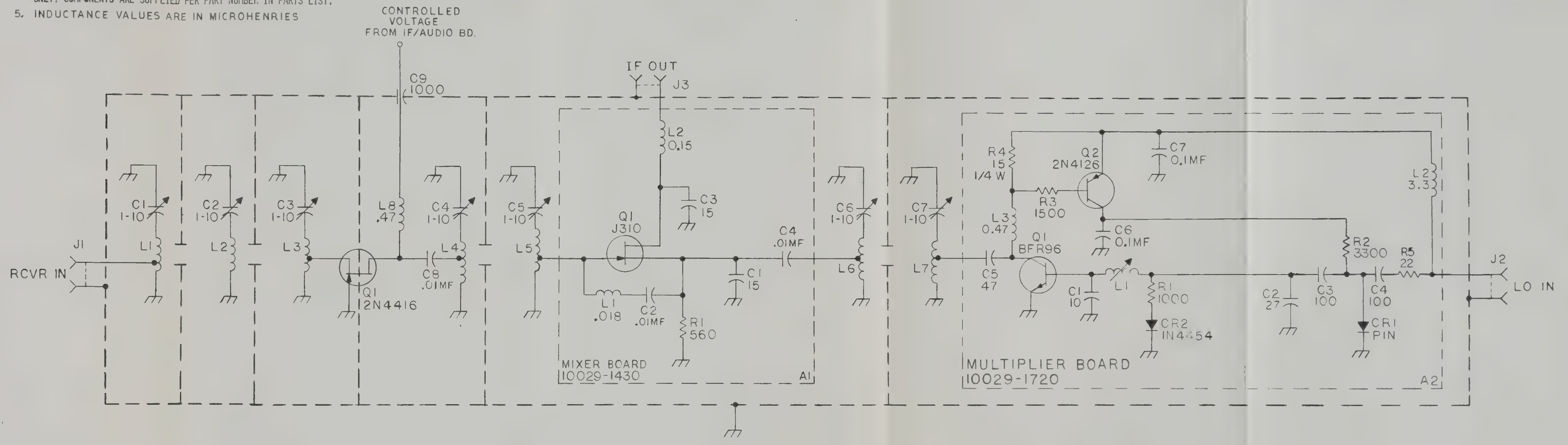


Figure 4. UHF Multiplier Board A2, Component Location Diagram

NOTES: UNLESS OTHERWISE SPECIFIED:

1. PARTIAL REFERENCE DISIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER AND/OR ASSEMBLY DESIGNATION.
2. RESISTOR VALUES ARE IN OHMS.
3. CAPACITOR VALUES ARE IN PF.
4. VENDOR AND/OR JEDEC PART NUMBER CALLOUTS ARE FOR REFERENCE ONLY: COMPONENTS ARE SUPPLIED PER PART NUMBER IN PARTS LIST.
5. INDUCTANCE VALUES ARE IN MICROHENRIES



HIGHEST REFERENCE DESIGNATION					
J3	C7	L7	Q1		A1C4
A1R1	A1Q1	A1L2	A2C7	A2R5	A2L3
A2Q2	A2CR2				
REFERENCE DESIGNATIONS NOT USED					

Figure 5. UHF Receiver Front End Module, Schematic Diagram

TABLE 5

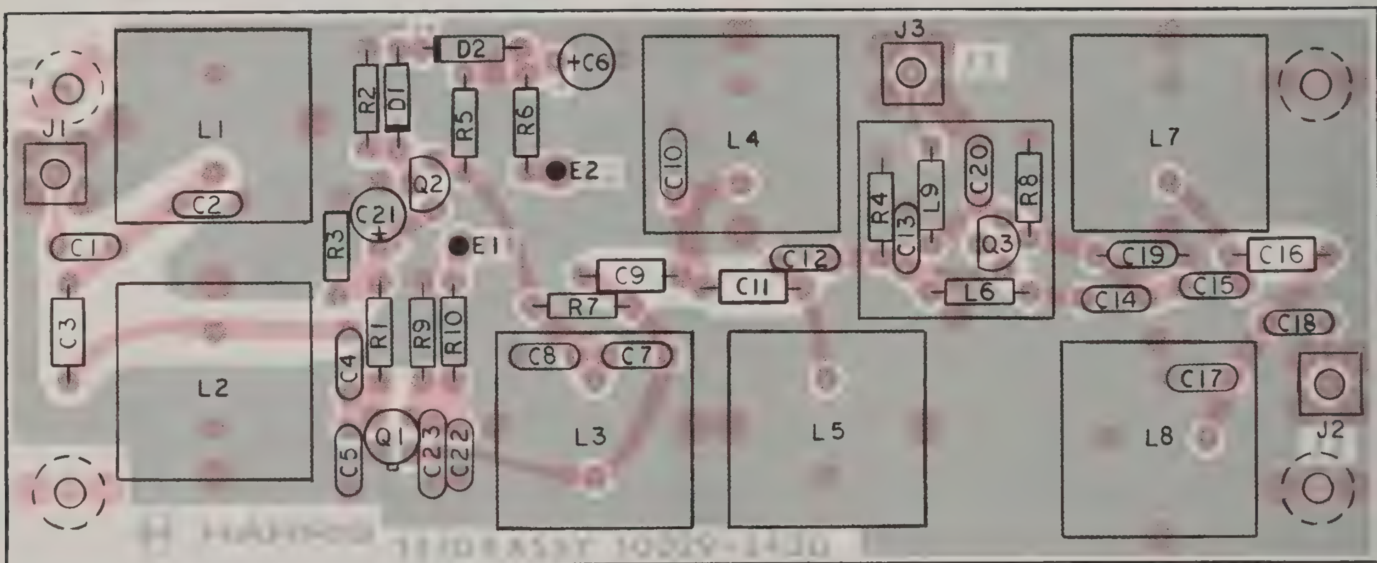
VHF Receiver Front End Module, Parts List

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
A4	VHF RX FRT END MOD	10029-2400
C1	Capacitor, Ceramic, 3.6 pF, 1000V	C-6612
C2	Capacitor, Ceramic, 3.6 pF, 1000V	C-6612
C3	Capacitor, Tubular, 0.68 pF, 500V	C-4604
C4	Capacitor, Ceramic, 13 pF, 1000V	C-6619
C5	Capacitor, Ceramic, 10 pF, 1000V	C-4741
C6	Capacitor, Tantalum, 10 μF, 20V	C-6448
C7	Capacitor, Ceramic, 4.3 pF, 1000V	C-6613
C8	Capacitor, Ceramic, 150 pF, 500V	C-3502
C9	Capacitor, axial, 0.3 pF	C-4595
C10	Capacitor, Ceramic, 6.8 pF, 1000V	C-4739
C11	Capacitor, axial, 0.2 pF	C-4591
C12	Capacitor, Ceramic, 13 pF, 1000V	C-6619
C13	Capacitor, Ceramic, 15 pF, 1000V	C-4743
C14	Capacitor, Ceramic, 0.01 μF, 150V	C-0065
C15	Capacitor, Ceramic, 11 pF, 1000V	C-6618
C16	Capacitor, Tubular, 0.75 pF, 500V	C-4605
C17	Capacitor, Ceramic, 4.7 pF, 1000V	C-4736
C18	Capacitor, Ceramic, 4.7 pF, 1000V	C-4736
C19	Capacitor, Ceramic, 68 pF, 1000V	C-4755
C20	Capacitor, Ceramic, 15 pF, 1000V	C-4743
C21	Capacitor, Tantalum, 1μF, 20V	C25-0002-301
C22	Not used	
C23	Capacitor, Ceramic, 0.1 μF, 50V	C-3202

TABLE 5

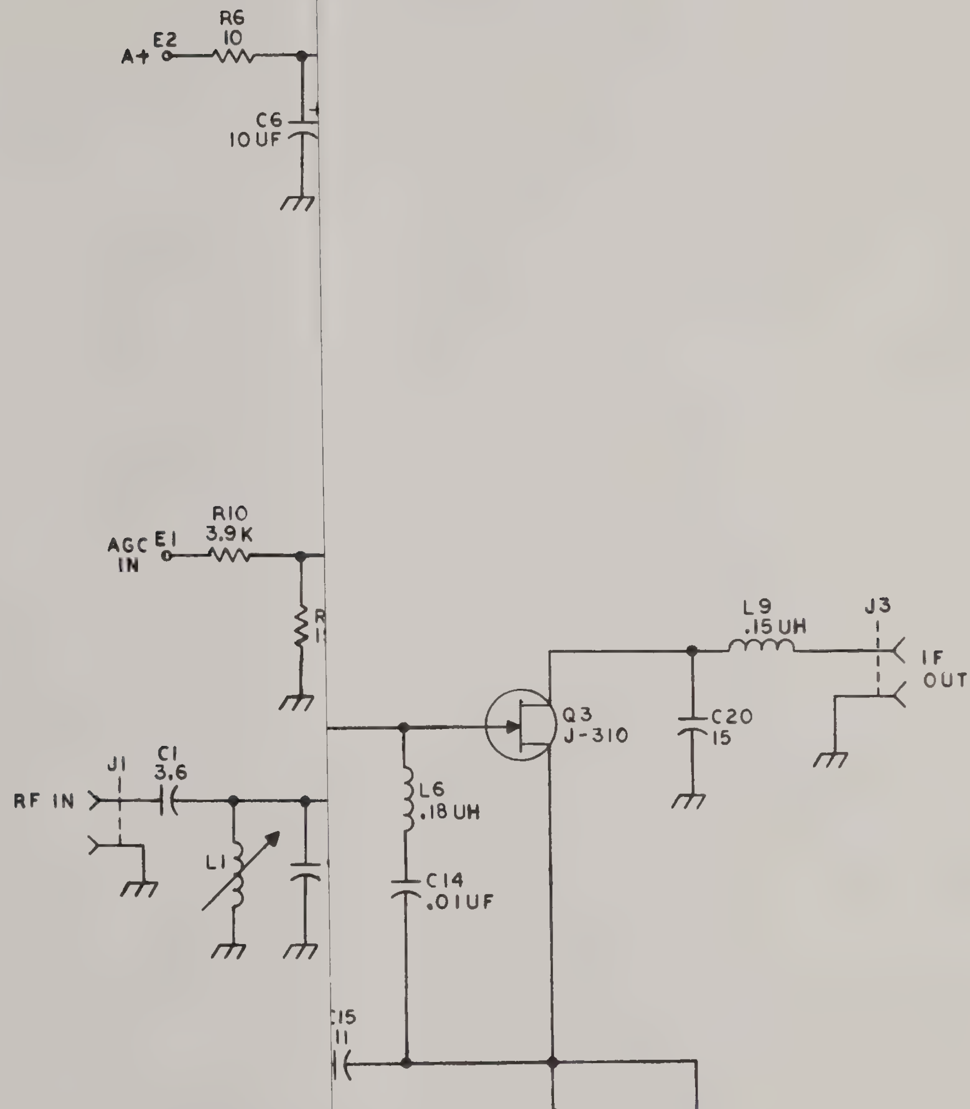
VHF Receiver Front End Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
CR1	Diode, Signal, 1N4454	D10-4454-000
CR2	Diode, Signal, 1N4454	D10-4454-000
L1	Coil, Adjustable	10029-2950
L2	Coil, Adjustable	10029-2950
L3	Coil, Adjustable	10029-2950
L4	Coil, Adjustable	10029-2950
L5	Coil, Adjustable	10029-2950
L6	Coil, rf, molded, 0.18 μH	L-0607
L7	Coil, Adjustable	10029-2950
L8	Coil, Adjustable	10029-2950
L9	Coil, rf, molded, 0.15 μH	L-0606
Q1	Transistor, SD-306	Q40-0001-000
Q2	Transistor, 2N4126	Q-0386
Q3	Transistor, J-310	Q35-0001-001
R1	Resistor, Composition, 18K ohm $\pm$ 5%, ¼ W	R-1279
R2	Resistor, Composition, 18K ohm $\pm$ 5%, ¼ W	R-1279
R3	Resistor, Composition, 18K ohm $\pm$ 5%, ¼ W	R-1279
R4	Resistor, Composition, 18K ohm $\pm$ 5%, ¼ W	R-1279
R5	Resistor, Composition, 47 ohm $\pm$ 5%, ¼ W	R-1217
R6	Resistor, Composition, 10 ohm $\pm$ 5%, ¼ W	R-1201
R7	Resistor, Composition, 4.7K ohm $\pm$ 5%, ¼ W	R-1265
R8	Resistor, Composition, 560 ohm $\pm$ 5%, ¼ W	R-1243
R9	Resistor, Composition, 15K ohm $\pm$ 5%, ¼ W	R-1277
R10	Resistor, Composition, 10K ohm $\pm$ 5%, ¼ W	R-1263
	Shields (L1-L8)	850-0038



NOTE:
- COMPONENTS SHOWN IN SOLID BLACK
- FACING SIDE FOIL SHOWN IN BLACK SCREEN
- OPPOSITE SIDE FOIL SHOWN IN RED SCREEN

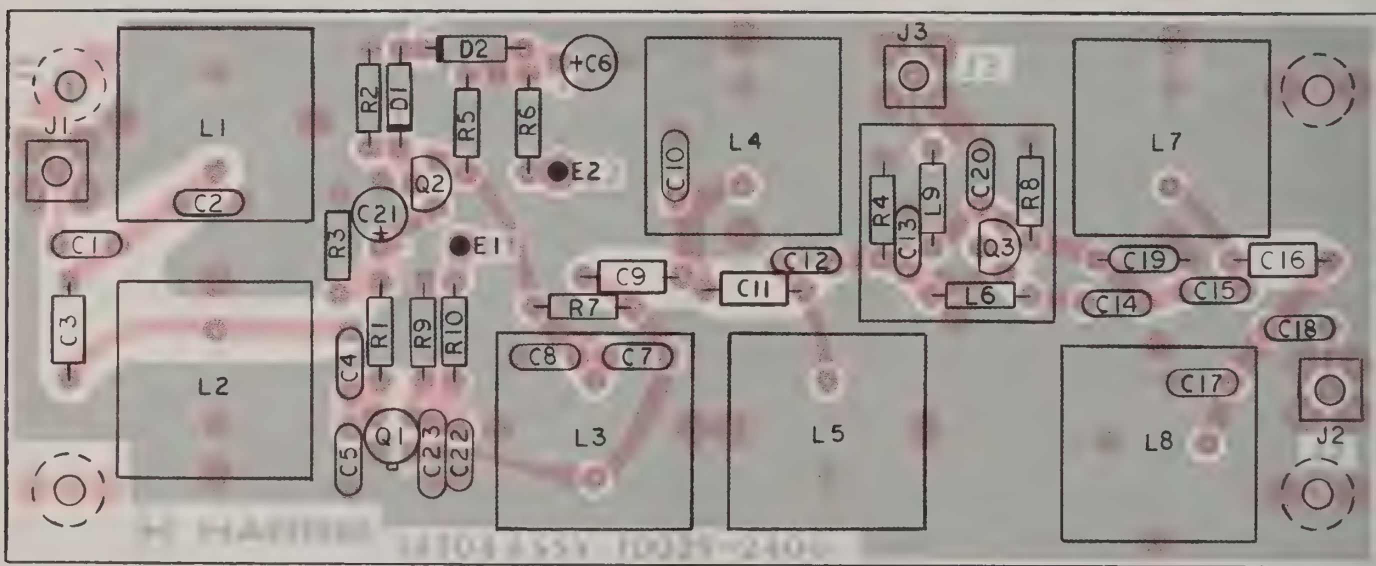
Figure 6. VHF Receiver Front End Module, Component Location Diagram



NOTES: UNLESS OTHERWISE SPECIFIE

1. PARTIAL REFERENCE DESIGNATI
   DESIGNATION PREFIX WITH UNIT
   DESIGNATION.
2. RESISTOR VALUES ARE IN OHMS,
3. CAPACITOR VALUES ARE IN PF
4. VENDOR AND/OR JEDEC PART NUM
   ONLY: COMPONENTS ARE SUPPLIE

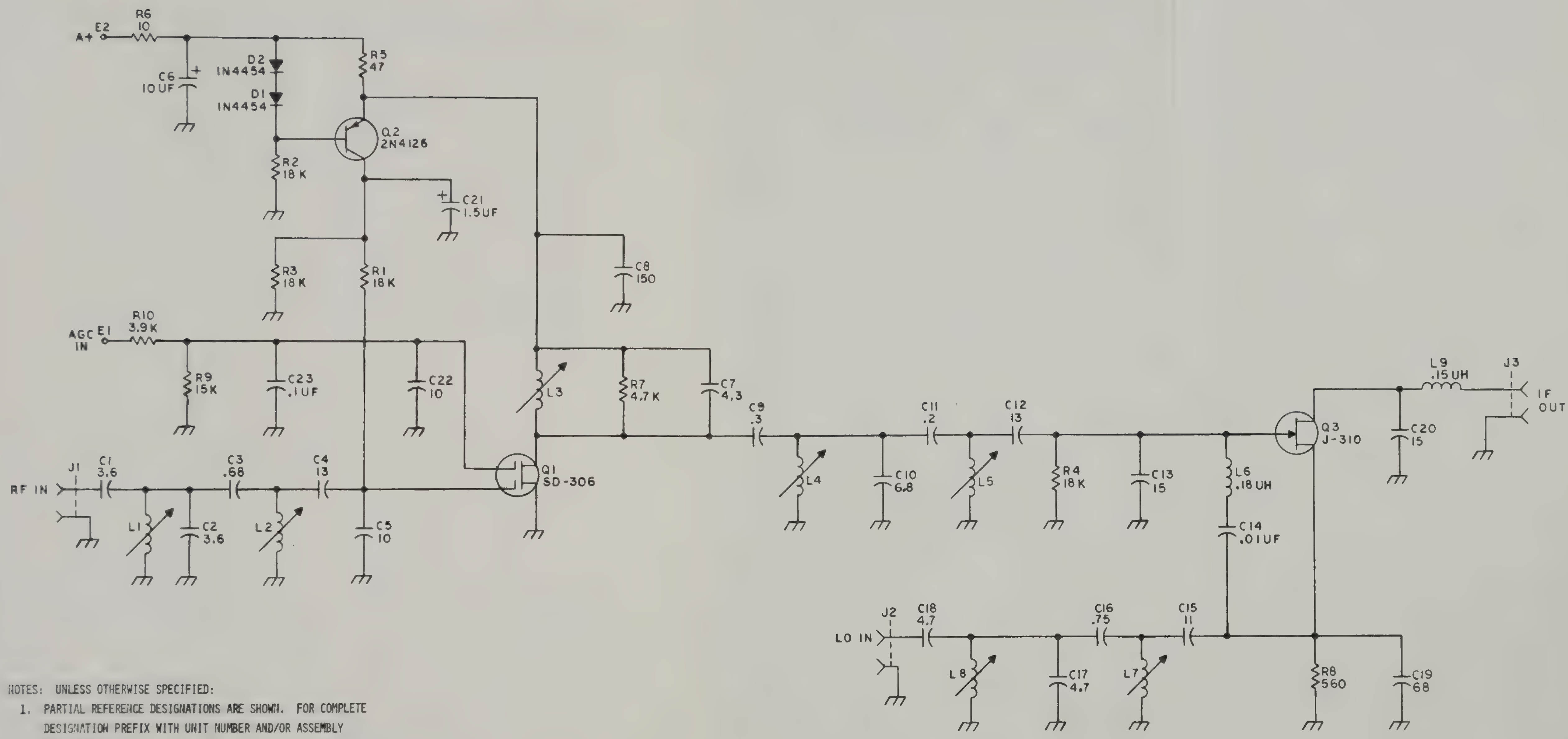
Figure 7. VHF Receiver Front End Module, Schematic Diagram



NOTE:

- COMPONENTS SHOWN IN SOLID BLACK
- FACING SIDE FOIL SHOWN IN BLACK SCREEN
- OPPOSITE SIDE FOIL SHOWN IN RED SCREEN

Figure 6. VHF Receiver Front End Module, Component Location Diagram



NOTES: UNLESS OTHERWISE SPECIFIED:

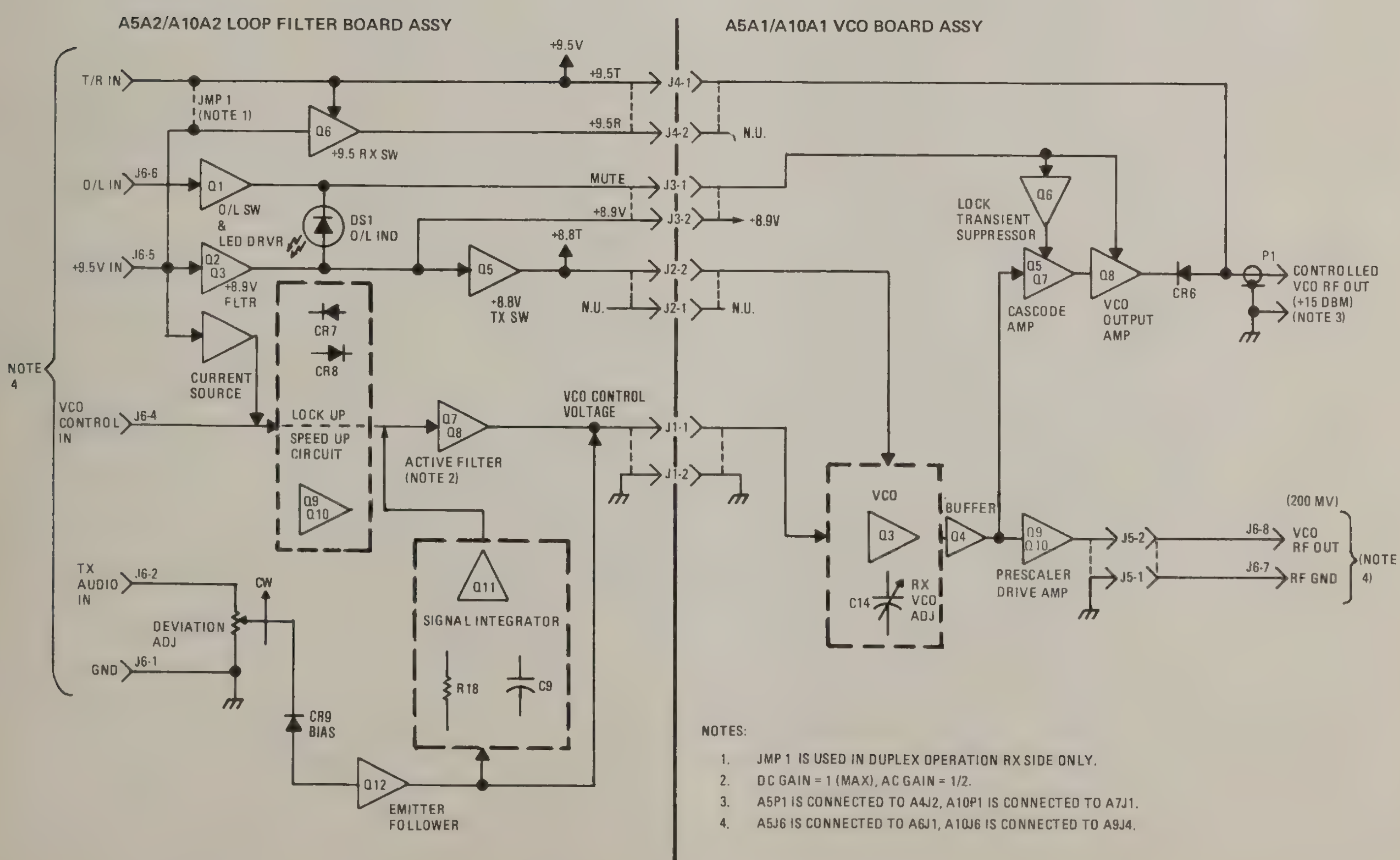
1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER AND/OR ASSEMBLY DESIGNATION.
2. RESISTOR VALUES ARE IN OHMS, 1/4W, 5%
3. CAPACITOR VALUES ARE IN PF
4. VENDOR AND/OR JEDEC PART NUMBER CALLOUTS ARE FOR REFERENCE ONLY: COMPONENTS ARE SUPPLIED PER PART NUMBER IN PARTS LIST.

Figure 7. VHF Receiver Front End Module, Schematic Diagram

A5/A10

RX/TX VCO MOD

TYPE	REF. DESIG.	TRANSCEIVER OPERATING FREQUENCY	MODULE PART NUMBER
TX HIGH	A10	450–512 MHz	10029–0500
RX MED	A5	406–512 MHz	10029–0501
TX LOW	A10	406–450 MHz	10029–0502
TX HIGH	A10	150–174 MHz	10029–2500
RX HIGH	A5	150–174 MHz	10029–2501
TX LOW	A10	132–150 MHz	10029–2502
RX LOW	A5	132–150 MHz	10029–2503



NOTES:

1. JMP 1 IS USED IN DUPLEX OPERATION RX SIDE ONLY.
2. DC GAIN = 1 (MAX), AC GAIN = 1/2.
3. A5P1 IS CONNECTED TO A4J2, A10P1 IS CONNECTED TO A7J1.
4. A5J6 IS CONNECTED TO A6J1, A10J6 IS CONNECTED TO A9J4.

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1. GENERAL DESCRIPTION

1.01 The major functions for UHF/VHF Transmit (Tx) and Receive (Rx) VCO Modules A10 and A5 are shown on the tab section cover diagram. There are three different VCO Board Assemblies and four different Loop Filter Board Assemblies, but regardless of their combination they all function in a similar manner in the Tx/Rx synthesizer loop in the Transceiver. Table 1 shows the different combinations of the seven types of board assemblies which may be ordered.

1.02 Table 2 shows the frequency range for the different combinations of modules. The different component values and jumper configurations are shown on the schematic diagrams, figures 3 and 5, and on the parts list, tables 5 and 6.

1.03 The VCO Board Assembly A1 and Loop Filter Board Assembly A2 are both mounted in a die-cast housing designed to shield the two circuit assemblies and provide a mechanically and electrically stable environment for the VCO Module. The die-cast housing mounts on the chassis. Power and control signal connections to/from Master Synthesizer Logic Module A9 in Transmit (Tx) and to/from Slave Synthesizer Logic Module A6 in Receive (Rx) are made via a connector on the Loop Filter Board Assembly for the respective VCO modules.

TABLE 1

VCO Module Combinations

REF DESIG	UHF OR VHF	TX OR RX	OPERATING FREQUENCY BAND	A5/ A/10	VCO PC BD A1	LP FLTR PC BD A2
A10	UHF	Tx	450-512 MHz	0500	0530	0580
A5	UHF	Rx	406-512 MHz	0501	0540	0520
A10	UHF	Tx	406-450 MHz	0502	0570	0580
A10	VHF	Tx	150-174 MHz	2500	0530	0590
A5	VHF	Rx	150.8-174 MHz	2501	0570	0560
A10	VHF	Tx	132-150.8 MHz	2502	0570	0590
A5	VHF	Rx	132-150.8 MHz	2503	0530	0560

TABLE 2

VCO Tuning Range Frequency in MHz

VCO P/N	VCO TYPE	TUNE RANGE
10029-0530	High	150-174 MHz
10029-0540	Medium	142.5-163.5 MHz
10029-0570	Low	129.4-152.6 MHz

1.04 The VCO Module and the Master Synthesizer Logic Module form the transmit synthesizer loop, while the Rx VCO Module and the Slave Synthesizer Logic Module form the receive synthesizer loop for both UHF and VHF Transceivers. The Tx VCO operates at one-third the desired frequency in UHF and at the desired frequency in VHF. The Rx VCO operates at one-third the desired Local Oscillator (LO) frequency in UHF and at desired LO frequency in VHF. The VCO Modules are designed for good short term stability and low noise performance. The output (Rx/Tx) of the VCO is divided to a lower frequency by a dual modulus prescaler on the appropriate synthesizer module. The output of the prescaler drives a variable ratio divider in the LSI. A fixed ratio divider on the same module divides the crystal oscillator frequency standard and generates a VCO control voltage proportional to the difference between them. This controlled voltage is filtered on the Loop Filter Board Assembly and combined with the modulation signal on the Tx Loop Filter Board, but not on the Rx Loop Filter Board to produce the respective Tx and Rx error signals to the Tx and Rx VCO Modules. These processed error signals act to keep the respective VCO Modules and the reference oscillator locked together. The frequency that each VCO Module generates is determined by the value of division ratio and reference frequency (5.0 KHz or $4.16\overline{6}$ KHz) selected on the associate synthesizer module. The division ratios are stored in PROM U3 on the Master Synthesizer Logic Module.

1.05 In the VHF Receiver, high side injection is used in the 132 to 150.8 MHz band and low side injection is used in the 150.8 to 174 MHz band. Thus, the Rx VCO will be operating in the opposite band that the Receiver is operating in. For example, a Receiver is operating in the 150.8 to 174 MHz range would require a 150.8 to 174 MHz VHF Rx VCO Module (10029-2501) which includes a low VCO board (10029-0570) tuning 129.4 to 152.6 MHz.

1.06 In the UHF Receiver, high side injection is used in the 406 to 450 MHz band and low side injection is used in the 450 to 512 MHz band. The medium VCO (10029-0540) when tripled in Receiver Front End Module A4, has sufficient tuning range to cover both high side and low side injection and is the only UHF Rx VCO needed.

2. INTERFACE CONNECTIONS

A. General Information

2.01 The UHF and VHF interface connections for both the Rx and Tx VCO Modules are identical.

B. UHF/VHF Receive (Rx) VCO Interface Connections

2.02 Table 2 summarizes all of the interface connections for Rx VCO Module.

TABLE 3

UHF/VHF Rx VCO Module Interface Summary

REF DESIG	FUNCTION	TO	FROM
P1	Controlled VCO Rf Out and +B to UHF Tripler	A4J2	—
P2-1	Gnd	—	A6J1-1
P2-2	Not Used	—	A6J1-2
P2-3	Not Used	—	A6J1-3
P2-4	VCO Control In	—	A6J1-4
P2-5	+9.5V In	—	A6J1-5
P2-6	O/L In	—	A6J1-6
P2-7	Rf Gnd	A6J1-7	—
P2-8	VCO Rf Out	A6J1-8	—

C. UHF/VHF Transmit (Tx) VCO Interface Connections

2.03 Table 4 summarizes all of the interface connections for Tx VCO Module.

TABLE 4

UHF/VHF Tx VCO Module Interface Summary

REF DESIG	FUNCTION	TO	FROM
P1	Controlled VCO RF Out and +B to UHF Exciter Mod	A7J1	—
P2-1	Gnd	—	A9J4-1
P2-2	Tx Audio In	—	A9J4-2
P2-3	T/R In	—	A9J4-3
P2-4	VCO Control In	—	A9J4-4
P2-5	+9.5V In	—	A9J4-5
P2-6	O/L In	—	A9J4-6
P2-7	Rf Gnd	A9J4-7	—
P2-8	VCO Rf Out	A9J4-8	—

3. SUPPLEMENTARY SEMICONDUCTOR DATA

3.01 Transistor lead identification diagrams will be found in the Chapter 4, Maintenance, chapter of this manual.

4. TECHNICAL DESCRIPTION

A1 = VCO Board Assembly
A2 = Loop Filter Board Assembly

4.01 Since all seven of the different VCO module combinations perform in a similar manner, one technical description will suffice for all explanations of any differences.

4.02 The rf output frequency range for the UHF/VHF and the Tx/Rx VCO's are shown in table 2.

4.03 Transistor A1Q3 and its associated circuitry on the VCO Board Assembly is a voltage-controlled oscillator that produces a frequency in the range of 129.4 to 174 MHz. The output of this VCO circuit is buffered by transistor A1Q4, then split to drive two cascode amplifiers comprised of A1Q5/Q7 and A1Q9/Q10. Amplifier A1Q9/Q10 drives the prescaler on the Synthesizer Logic Board. The output of amplifier Q5/Q7 is controlled by the O/L (Out-of-Lock) signal from O/L switch A2Q1 on the Loop Filter Board Assembly. Buffer A1Q5/Q7 is activated only when the VCO and the crystal reference are locked with each other. Transistor A1Q6 and its associated circuitry, act as a lock transient suppressor for the O/L signal. VCO output amplifier A1Q8 raises the Controlled VCO Rf Output signal to +15 dB to drive Tx Exciter Module A7 or Receive Front End Module through P1 and also supplies +B to the UHF Tx Exciter. VCO adjust trimmer A1C14 is the course adjustment for the VCO and will tune it over its nominal range (see table 2). Varicaps A1CR3 and A1CR4 tune the VCO within ±0.6% of the frequency set by A1C14 in response to the VCO control voltage. In the Tx VCO, Tx audio is also applied to varicaps A1CR3 and A1CR4 to frequency modulate the transmitted signal.

4.04 The Loop Filter Board Assembly performs several interface functions between the appropriate synthesizer logic module (Master or Slave) and the VCO Board Assembly. The O/L In signal from the synthesizer applies +5V through resistor R3 to the base of O/L Switch A2Q1, which shuts off the bias for transistors A1Q7 and A1Q8 in an unlocked condition. At the same time a ground is applied to LED A2DS1 in the A2Q1 collector circuit, which lights whenever the loop is unlocked. Transistors A2Q5 and A2Q6 are used to switch transmit (Tx) and receive (Rx) control voltages for the VCO and Loop Filter Board Assemblies. Transistors A2Q2 and A2Q3 act as a filter for the VCO B+ voltage.

4.05 Transistors A2Q7 and A2Q8 form an active filter for the VCO control voltage from the synthesizer. Transistors A2Q9 and A2Q10 provide a lock speed-up function. Transistor A2Q13 is the current source for the VCO Control Voltage. In a transmit VCO Module (UHF or VHF) the Tx Audio Signal (modulation voltage) is injected into the loop via Deviation Adjust control A3A2R26 and emitter followers A2Q12 and A2Q11.

4.06 The Loop Filter Board Assembly is designed to serve as both a receive or a transmit unit by installing JMP1 for receive and removing JMP1 for transmit.

5. MAINTENANCE

A. General Information

5.01 All significant signal and control inputs and outputs are shown on the tab section cover diagram and in the schematic diagrams of this tab section. The adjustments indicated by the alignment procedures described in this section are made at the factory prior to shipment. Normally, it is not necessary to repeat any of these adjustments unless there are component failures or unless readjustment becomes necessary for some other specific reason. The transmit (Tx) or receive (Rx) VCO Module adjustments are made in conjunction with their associated Synthesizer Logic Modules (Master for Tx and Slave for Rx adjustments). Removal of the Transceiver cover facilitates the maintenance and adjustment of the previously aforementioned modules, by making all necessary test points available.

CAUTION

Always disconnect power when removing or installing subassemblies.

B. Synthesizer Tune Up (25°C)

(a) Confirm that the correct configuration of jumper JMP3 is in (UHF) or out (VHF) on the Master Synthesizer Logic Module for desired operation.

(b) Confirm that JMP1 is installed for RX VCO operation (A5), and removed for TX VCO operation (A10).

(c) Make sure the correct PROM (U3) on the Master Synthesizer Logic Module is in place.

(d) Check to ensure A9JMP2 is in for VHF operation and removed for UHF operation.

(e) Connect power and Control Unit. Set Control Unit for manual operation.

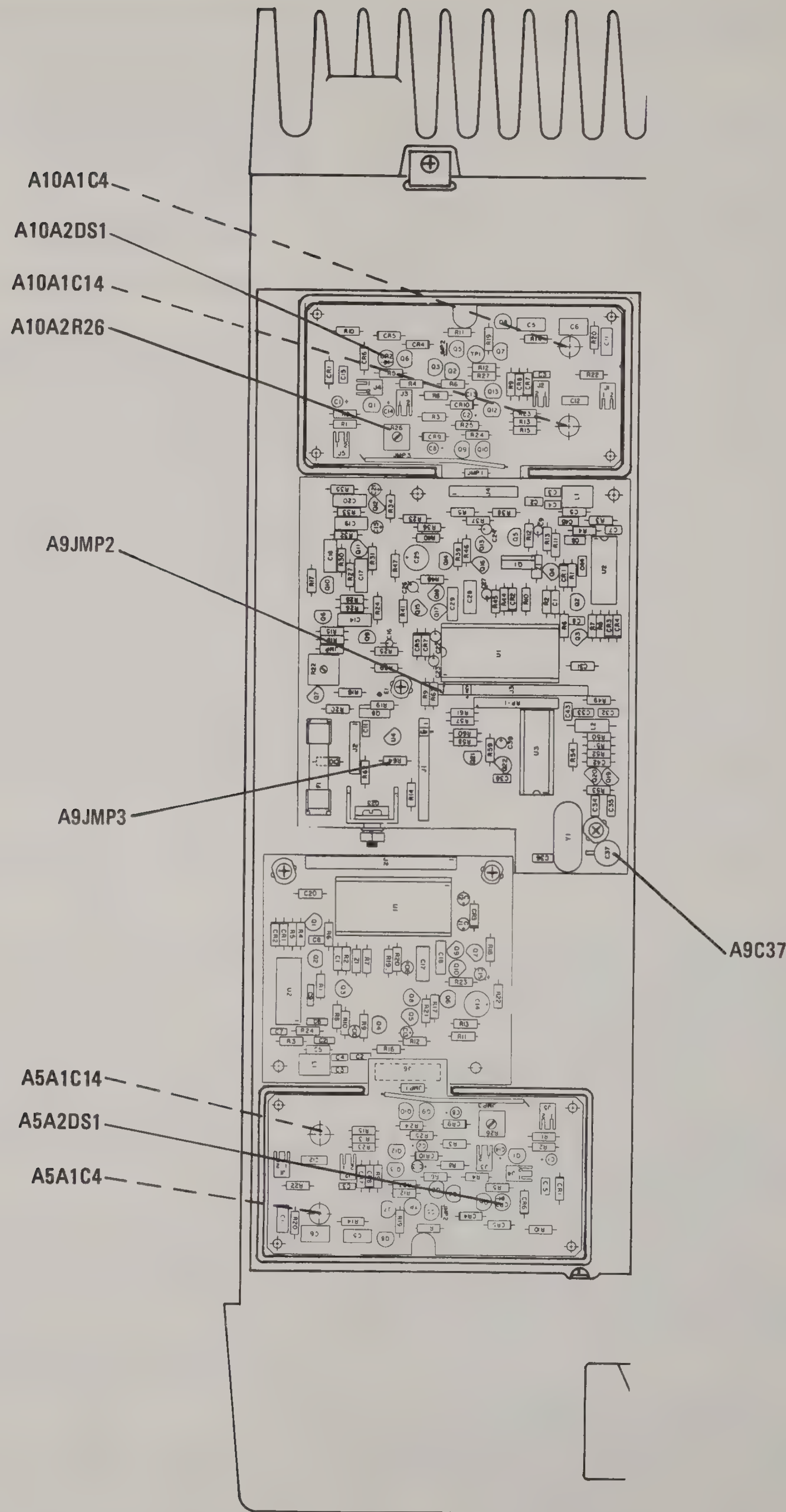


Figure 1. UHF/VHF, RX/TX VCO Module, Adjustments and Indicators

C. Rx Tune Up

(a) If the Transceiver is not locked up, O/L indicator lamps A8DS1 and A5A2DS1 will light. If this is the case, adjust VCO Adjust trimmer A1C14 until O/L indicator lamps go out. Adjust A1C14 so that the dc voltage measured at A2TP1 is ≈5.6 Vdc at the center channel frequency.

(b) Check to ensure that all channels will lock up.

D. Tx Tune Up

(a) Remove transmit power to PA Module A1 by disconnecting the cable from A1P1 to A7J2.

(b) The transmit tune up is similar to the receive tune up except for the long time delay between lock up and indication on O/L indicator lamp A8CR21. Turning VCO Adjust trimmer A1C14 at about 3/10 of a turn per second, with Transmitter keyed, will allow the lamp to go out before going out of range.

(c) Once O/L indicator is out, adjust Tx VCO Adjust trimmer so that dc voltage measured at test point A1TP1 is ≈5.6 Vdc at Tx center frequency.

(d) Reconnect input cable to PA Module A1P1 and A7J2.

6. PARTS LIST

A. UHF/VHF, Rx/Tx VCO Modules

6.01 Table 1 identifies and summarizes the seven different types of VCO modules used in the Rx or Tx sections of the UHF or VHF Transceivers.

B. UHF/VHF, Rx/Tx VCO Board Assemblies

6.02 Table 5 lists and identifies all of the parts for all VCO Board Assemblies used in the UHF/VHF, Rx/Tx VCO Modules. When a part is used in more than one assembly, the part will be listed however many times it is used and each respective use will be identified separately.

6.03 Figure 2 gives the component location information for the following types of VCO Board Assemblies:

(a) 10029-0530

(b) 10029-0540

(c) 10029-0570

C. UHF/VHF, Rx/Tx Loop Filter Board Assemblies

6.04 Table 6 lists and identifies all of the parts for all Loop Filter Board Assemblies used in the UHF/VHF, Rx/Tx VCO Modules. When a part is used in more than one assembly, but has a different value or part number, the part will be listed however many times it is used and each respective use will be identified separately.

6.05 Figure 4 gives the component location information for the following types of Loop Filter Board Assemblies:

(a) 10029-0520

(b) 10029-0560

(c) 10029-0580

(d) 10029-0590

7. SCHEMATIC DIAGRAMS

A. UHF/VHF, Rx/Tx VCO Board Assemblies

7.01 Figure 3 is the schematic diagram applicable to all VCO Board Assemblies.

B. UHF/VHF, Rx/Tx Loop Filter Board Assemblies

7.02 Figure 5 is the schematic diagram applicable to all Loop Filter Board Assemblies.

TABLE 5

VCO Board Assemblies A5A1/A10A1, Parts List (for -0530, -0540, and -0570)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
A5A1/ A10A1	VCO BOARD ASSEMBLY, HIGH VCO BOARD ASSEMBLY, MEDIUM VCO BOARD ASSEMBLY, LOW	10029-0530 10029-0540 10029-0570
C1	Not Used	
C2	Not Used	
C3	Not Used	
C4	Not Used	
C5	Not Used	
C6	Not Used	
C7	Not Used	
C8	Not Used	
C9	Not Used	
C10	Not Used	
C11	Capacitor, Ceramic, 470 pF	C11-0016-471
C12 (-0530)	Capacitor, Ceramic, NPO, 9.1 pF	10029-0984
C12 (-0540)	Capacitor, Ceramic, 10 pF	C11-0015-100
C12 (-0570)	Capacitor, Ceramic, 10 pF	C11-0015-100
C13 (-0530)	Capacitor, Ceramic, 9.1 pF	10029-0980
C13 (-0540)	Capacitor, Ceramic, 10 pF	10029-0983
C13 (-0570)	Capacitor, Ceramic, 11 pF	10029-0981
C14	Capacitor, Trimmer, 0.8 to 10 pF	C85-0001-001
C15 (-0530)	Capacitor, Ceramic, 2 pF	10029-0979

TABLE 5

VCO Board Assemblies A5A1/A10A1, Parts List (for -0530, -0540, and -0570) (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
C15 (-0540)	Capacitor, Ceramic, NPO, 3 pF	10029-0982
C15 (-0570)	Capacitor, Ceramic, 5.6 pF	C11-0015-056
C16	Capacitor, Tantalum, 6.8 μF, 15V	C25-0033-685
C17	Capacitor, Ceramic, 0.01 μF	C11-0009-103
C18	Capacitor, Ceramic, 4.7 pF	C11-0015-047
C19	Capacitor, Ceramic, 10 pF	C11-0015-100
C20	Capacitor, Ceramic, 470 pF	C11-0016-471
C21	Capacitor, Tantalum, 6.8 μF, 15V	C25-0033-685
C22	Capacitor, Ceramic, 470 pF	C11-0016-471
C23	Capacitor, Ceramic, 470 pF	C11-0016-471
C24	Capacitor, Ceramic, 470 pF	C11-0016-471
C25	Capacitor, Ceramic, 5.6 pF	C11-0015-056
C26	Capacitor, Ceramic, 470 pF	C11-0016-471
C27	Capacitor, Ceramic, 470 pF	C11-0016-471
C28	Capacitor, Ceramic, 470 pF	C11-0016-471
C29	Capacitor, Ceramic, 470 pF	C11-0016-471
C30	Capacitor, Ceramic, 10 pF	C11-0015-100
C31	Capacitor, Ceramic, 220 pF	C11-0016-221
C32	Capacitor, Ceramic, 8.2 pF	C11-0015-082
C33	Capacitor, Ceramic, 10 pF	C11-0015-100
C34	Capacitor, Ceramic, 470 pF	C11-0016-471
C35	Capacitor, Ceramic, 2.7 pF	C11-0015-027
C36	Capacitor, Ceramic, 470 pF	C11-0016-471

TABLE 5

VCO Board Assemblies A5A1/A10A1, Parts List (for -0530, -0540, and -0570) (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
C37	Capacitor, Ceramic, 22 pF	C11-0015-220
C38	Capacitor, Ceramic, 2.7 pF	C11-0015-027
C39	Capacitor, Ceramic, 470 pF	C11-0016-471
C40	Capacitor, Ceramic, 470 pF	C11-0016-471
C41	Capacitor, Ceramic, 470 pF	C11-0016-471
C42	Capacitor, Ceramic, 22 pF	C11-0015-220
CR1	Not Used	
CR2	Not Used	
CR3	Diode, Silicon	D25-0001-001
CR4	Diode, Silicon	D25-0001-001
CR5	Diode, Switching, 1N6263	D10-6263-000
CR6	Diode, PIN	CR-0746
CR7	Not Used	
CR8	Diode, Hot Carrier	CR-0454
J1	Pin, Square Wire	J01-0001-000
J2	Pin, Square Wire	J01-0001-000
J3	Pin, Square Wire	J01-0001-000
J4	Pin, Square Wire	J01-0001-000
J5	Pin, Square Wire	J01-0001-000
L1	Not Used	
L2	Not Used	
L3	Not Used	
L4	Coil, rf, molded, 1 μH	L-0616
L5	Inductor, rf	6627-2635

TABLE 5

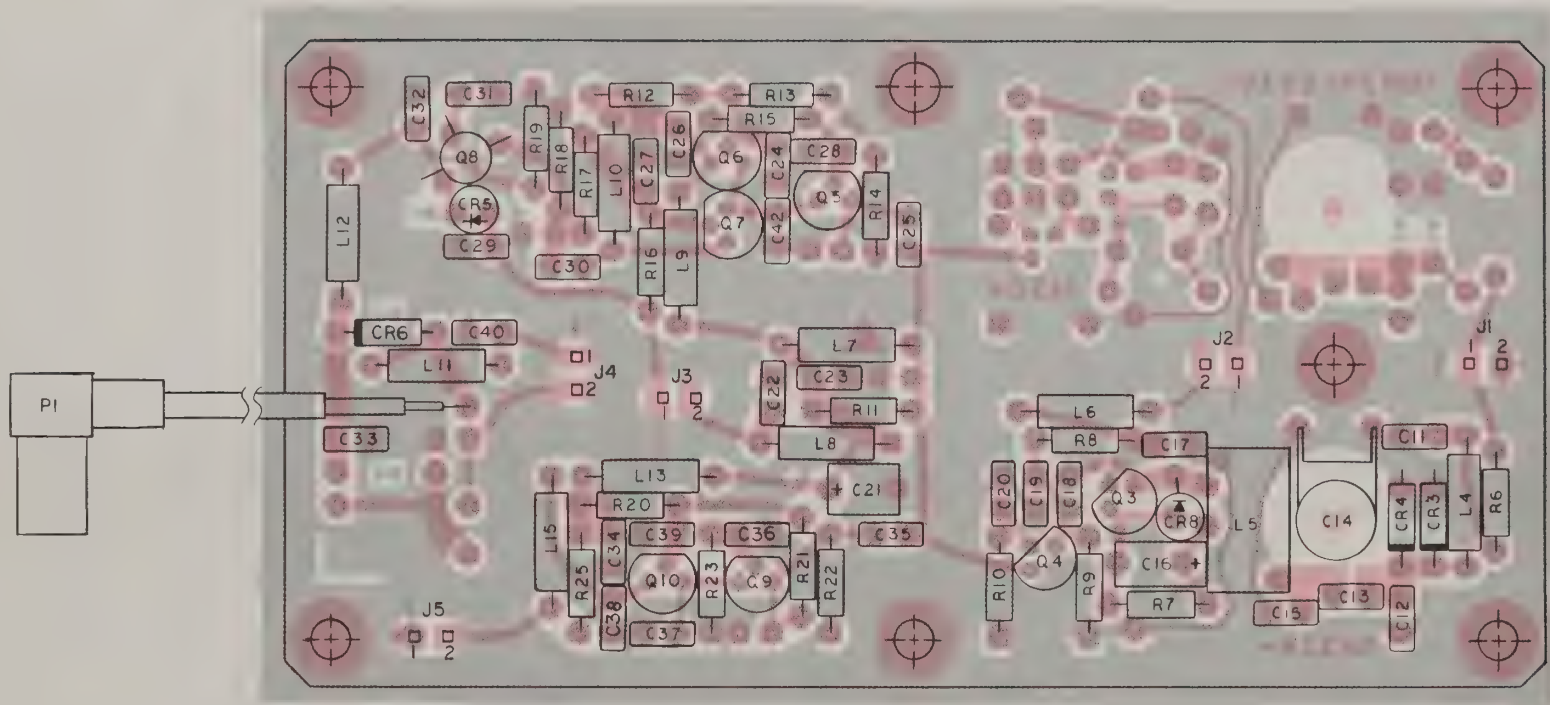
VCO Board Assemblies A5A1/A10A1, Parts List (for -0530, -0540, and -0570) (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
L6	Coil, rf, molded, 1 μH	L-0616
L7	Coil, rf, molded, 0.1 μH	L-0653
L8	Coil, rf, molded, 1 μH	L-0616
L9	Coil, rf, molded, 1 μH	L-0616
L10	Coil, rf, molded, 0.1 μH	L-0653
L11	Coil, rf, molded, 1 μH	L-0616
L12	Coil, rf, molded, 0.1 μH	L-0653
L13	Coil, rf, molded, 1 μH	L-0616
L14	Not Used	
L15	Coil, rf, molded, 0.12 μH	L-0654
P1	Coax Cable Assembly, VCO	10029-0550
Q1	Not Used	
Q2	Transistor, MPS-H10	Q25-0012-000
Q3	Transistor, K-211	Q35-0002-001
Q4	Transistor, MPS-H10	Q25-0012-000
Q5	Transistor, MPS-H10	Q25-0012-000
Q6	Transistor, MPS-6507	Q-0019
Q7	Transistor, MPS-6507	Q-0019
Q8	Transistor, TP390	10029-0992
Q9	Transistor, MPS-H10	Q25-0012-000
Q10	Transistor, MPS-6507	Q-0019
R1	Not Used	
R2	Not Used	

TABLE 5

VCO Board Assemblies A5A1/A10A1, Parts List (for -0530, -0540, and -0570) (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
R3	Not Used	R65-0001-084
R4	Not Used	R65-0001-009
R5	Not Used	R65-0001-084
R6	Resistor, Carbon Film, 10 ohm ± 5%, ⅛W	R65-0001-078
R7	Resistor, Carbon Film, 12K ohm ± 5%, ⅛W	R65-0001-080
R8	Resistor, Carbon Film, 6.8K ohm ± 5%, ⅛W	R65-0001-057
R9	Resistor, Carbon Film, 8.2K ohm ± 5%, ⅛W	R65-001-041
R10	Resistor, Carbon Film, 1K ohm ± 5%, ⅛W	R65-0001-074
R11	Resistor, Carbon Film, 220 ohm ± 5%, ⅛W	R65-0001-064
R12	Resistor, Carbon Film, 4.7K ohm ± 5%, ⅛W	R65-0001-064
R13	Resistor, Carbon Film, 1.8K ohm ± 5%, ⅛W	R65-0001-036
R14	Resistor, Carbon Film, 1.8K ohm ± 5%, ⅛W	R65-0001-046
R15	Resistor, Carbon Film, 130 ohm ± 5%, ⅛W	R65-0001-049
R16	Resistor, Carbon Film, 360 ohm ± 5%, ⅛W	R65-0001-056
R17	Resistor, Carbon Film, 470 ohm ± 5%, ⅛W	R65-0001-037
R18	Resistor, Carbon Film, 910 ohm ± 5%, ⅛W	R65-0001-080
R19	Resistor, Carbon Film, 150 ohm ± 5%, ⅛W	R65-0001-070
R20	Resistor, Carbon Film, 8.2K ohm ± 5%, ⅛W	R65-0001-068
R21	Resistor, Carbon Film, 3.3K ohm ± 5%, ⅛W	R65-0001-043
R22	Resistor, Carbon Film, 2.7K ohm ± 5%, ⅛W	
R23	Resistor, Carbon Film, 270 ohm ± 5%, ⅛W	R65-0001-043
R24	Not Used	
R25	Resistor, Carbon Film, 270 ohm ± 5%, ⅛W	
	Gasket, RF1 Shielding	Z-23-0014-001



A5/A10 Fig. 2

NOTES:

1. ALL PARTS TO BE FLUSH MOUNTED TO BOARD EXCEPT TRANSISTORS Q3,4,5,6,7,9 &10. MAX. HEIGHT TO TOP OF TRANSISTORS TO BE .30 INCHES.

NOTE:

- COMPONENTS SHOWN IN SOLID BLACK
- FACING SIDE FOIL SHOWN IN BLACK SCREEN
- OPPOSITE SIDE FOIL SHOWN IN RED SCREEN

Figure 2. VCO Board Assembly A5A1/A10A1, Component Location Diagram

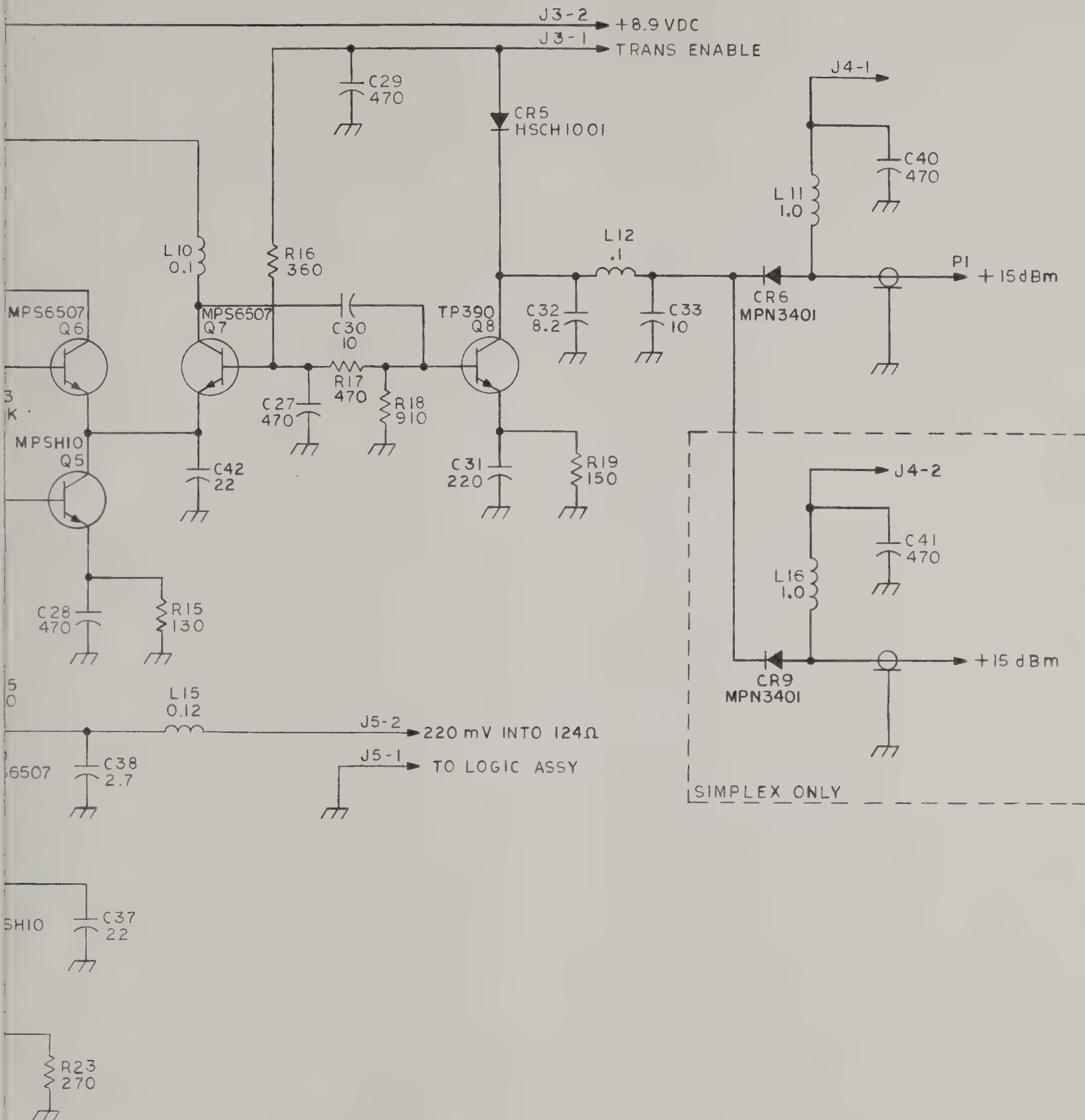
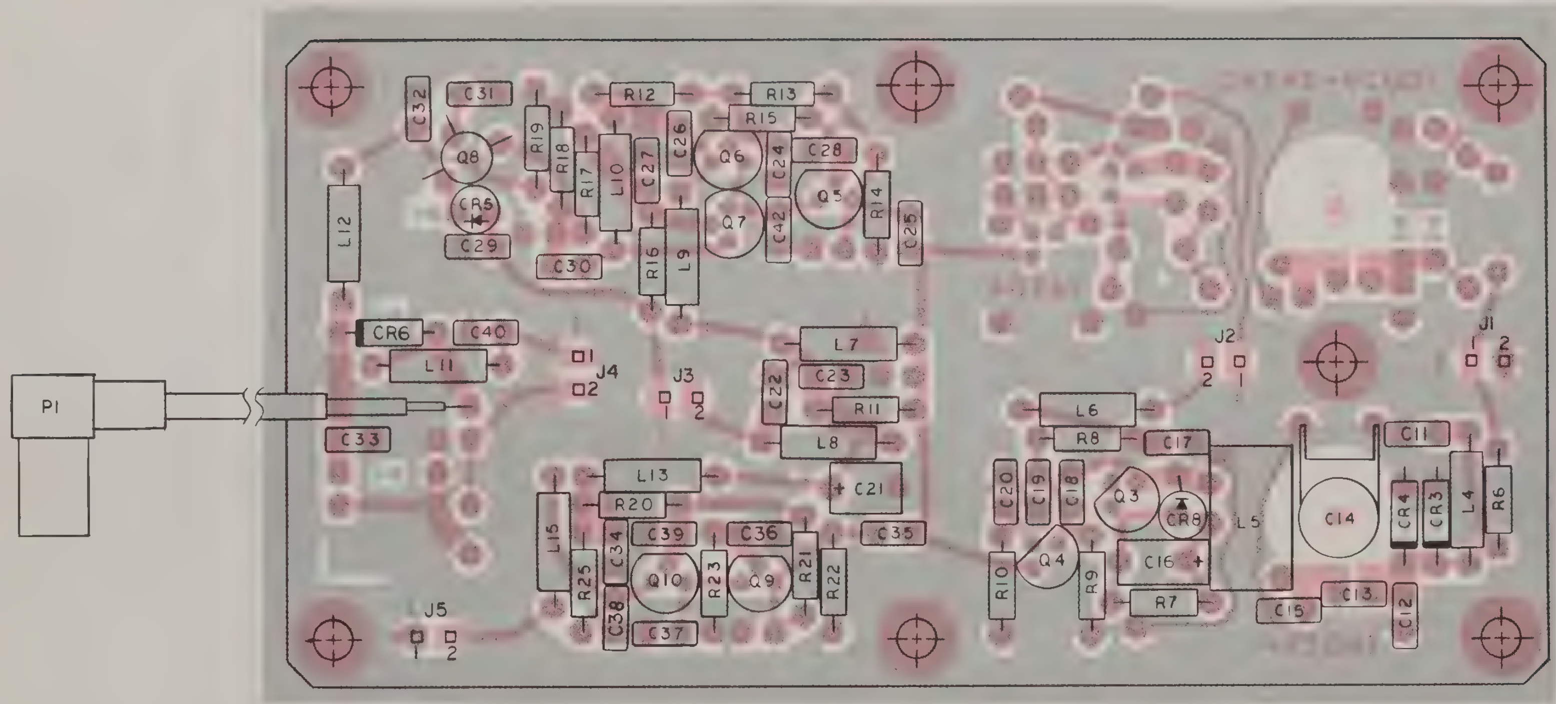


Figure 3. VCO Board Assembly A5A1/A10A1, Schematic Diagram



A5/A10 Fig. 2

NOTES:

1. ALL PARTS TO BE FLUSH MOUNTED TO BOARD EXCEPT TRANSISTORS Q3,4,5,6,7,9 &10. MAX. HEIGHT TO TOP OF TRANSISTORS TO BE .30 INCHES.

NOTE:

- COMPONENTS SHOWN IN SOLID BLACK
- FACING SIDE FOIL SHOWN IN BLACK SCREEN
- OPPOSITE SIDE FOIL SHOWN IN RED SCREEN

Figure 2. VCO Board Assembly A5A1/A10A1, Component Location Diagram

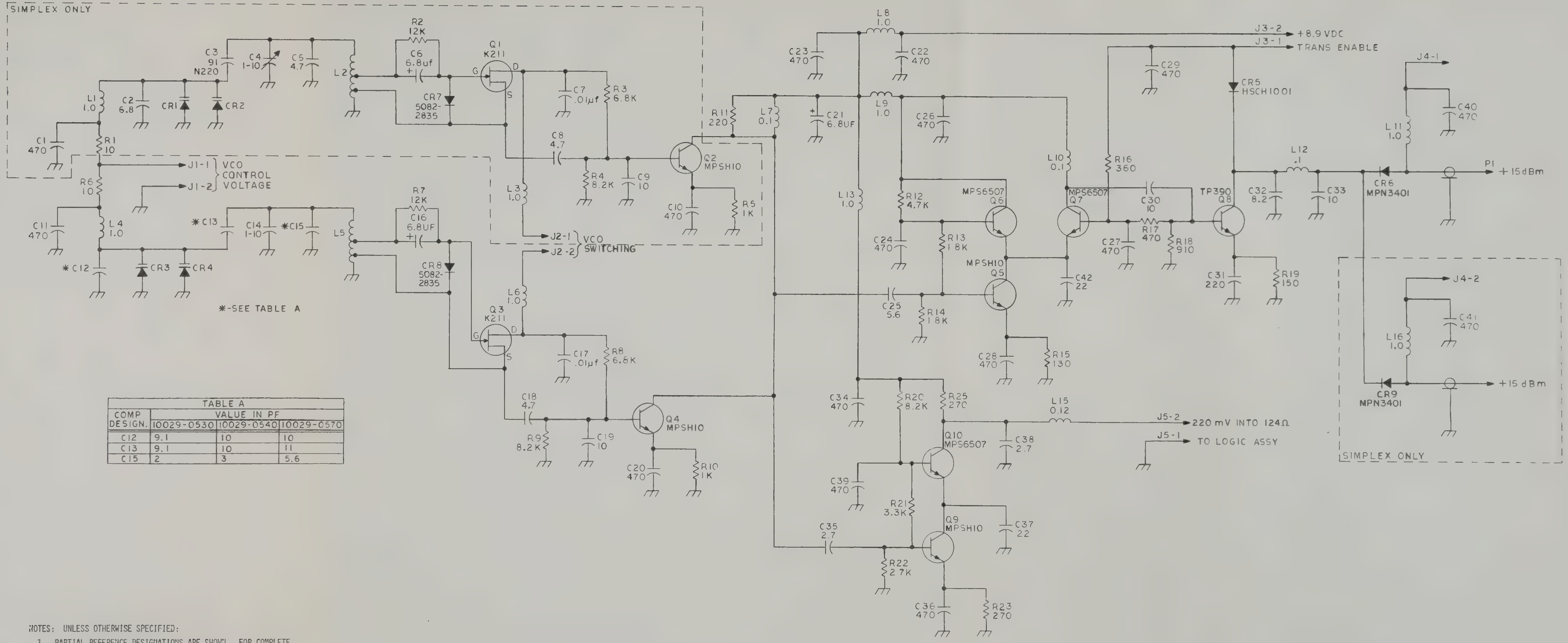


TABLE A			
COMP DESIGN.	VALUE IN PF		
	10029-0530	10029-0540	10029-0570
C12	9.1	10	10
C13	9.1	10	11
C15	2	3	5.6

NOTES: UNLESS OTHERWISE SPECIFIED:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER AND/OR ASSEMBLY DESIGNATION.
2. RESISTOR VALUES ARE OHMS, 1/8 W, 5%.
3. CAPACITOR VALUES ARE IN PF.
4. VENDOR AND/OR JEDEC PART NUMBER CALLOUTS ARE FOR REFERENCE ONLY; COMPONENTS ARE SUPPLIED PER PART NUMBER IN PARTS LIST.
5. ALL L's IN uh

HIGHEST REFERENCE DESIGNATION					
C42	R25	L16	J5	Q10	CR9
REFERENCE DESIGNATIONS NOT USED					
L14					

Figure 3. VCO Board Assembly A5A1/A10A1, Schematic Diagram

TABLE 6

Loop Filter Board Assemblies A5A2/A10A2, Parts List (for -0520, -0560, -0580, and -0590)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
A5A2/	LOOP FILTER BOARD ASSEMBLY, UHF RX	10029-0520
A5A2/	LOOP FILTER BOARD ASSEMBLY, VHF RX	10029-0560
A10A2	LOOP FILTER BOARD ASSEMBLY, UHF TX	10029-0580
A10A2	LOOP FILTER BOARD ASSEMBLY, VHF TX	10029-0590
C1	Capacitor, Tantalum, 3.3 MFD, 15V	C-3101
C2	Capacitor, Tantalum, 10 μF, 20V	C-6448
C3	Capacitor, Ceramic, 1000 pF	C11-0016-102
C4	Not Used	
C5	Capacitor, Mylar, 0.1 μF, 100V	C61-0001-002
C6	Capacitor, Mylar, 0.22 MFD, 100V	C61-0001-004
C7	Capacitor, Tantalum, 4.7 μF	10029-2953
C8	Capacitor, 3.3 μF	10029-2952
C9	Capacitor, Mylar, 0.1 μF, 100V	C61-0001-002
C10 (-0520)	Not Used	
C10 (-0560)	Capacitor, 1100 pF ± 5%	10029-2951
C10 (-0580)	Not Used	
C10 (-0590)	Capacitor 1100 pF ± 5%	10029-2951
C11 (-0520)	Capacitor, Mylar, 0.1 μF, 100V	C61-0001-002
C11 (-0560)	Capacitor, Mylar, 0.033 μF, 250V	C61-0001-110

TABLE 6

Loop Filter Board Assemblies A5A2/A10A2, Parts List (for -0520, -0560, -0580, and -0590) (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
C11 (-0580)	Capacitor, Mylar, 0.1 μF, 100V	C61-0001-002
C11 (-0590)	Capacitor, Mylar, 0.033 μF, 250V	C61-0001-110
C12	Capacitor, Tantalum, 4.7 μF	10029-2953
C13	Capacitor, Tantalum, 47 μF, 6V	C25-0010-607
C14	Capacitor, Tantalum, 1 μF, 20V	C-6442
C15	Capacitor, Ceramic, 0.1 μF, 50V	C11-0005-104
CR1	Diode, Signal, 1N4454	CR-0705
CR2	Not Used	
CR3	Not Used	
CR4	Diode, Signal, 1N4454	CR-0705
CR5	Diode, Signal, 1N4454	CR-0705
CR6	Diode, Signal, 1N4454	CR-0705
CR7	Diode, Signal, 1N4454	CR-0705
CR8	Diode, Signal, 1N4454	CR-0705
CR9	Diode, Signal, 1N4454	CR-0705
CR10	Diode, Signal, 1N4454	CR-0705
DS1	LED, Panel Lamp	919-4314
JMP1	Circuit Jumper (used on 0520 and 0560 only)	MP-1142
JMP2	Not Used	
JMP3	Wire, Insulated, No. 24, White, #24 AWG, WHT	W-1080
Q1	Transistor, 2N4124	Q-0385
Q2	Transistor, MPS-A18	Q25-0005-000

TABLE 6

Loop Filter Board Assemblies A5A2/A10A2, Parts List (for -0520, -0560, -0580, and -0590) (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
Q3	Transistor, 2N4401	Q02-4401-000
Q4	Not Used	
Q5	Transistor, 2N4126	Q-0386
Q6	Transistor, 2N4126	Q-0386
Q7	Transistor, PN4250	Q22-0001-000
Q8	Transistor, MPS-A18	Q25-0005-000
Q9	Transistor, 2N4124	Q-0385
Q10	Transistor, 2N4126	Q-0386
Q11	Transistor, 2N4126	Q-0386
Q12	Transistor, 2N4124	Q-0385
Q13	Transistor, 2N4126	Q-0386
R1	Resistor, Composition, 2.2K ohm ± 5%, ¼W	R-1257
R2	Resistor, Composition, 1.8K ohm ± 5%, ¼W	R-1255
R3	Resistor, Composition, 4.7K ohm ± 5%, ¼W	R-1265
R4	Resistor, Composition, 360 ohm ± 5%, ¼W	R-1238
R5	Resistor, Composition, 820 ohm ± 5%, ¼W	R-1247
R6	Resistor, Composition, 33K ohm ± 5%, ¼W	R-1285
R7	Not Used	
R8	Resistor, Composition, 4.7K ohm ± 5%, ¼W	R-1265
R9	Resistor, Composition, 33K ohm ± 5%, ¼W	R-1285
R10	Resistor, Composition, 3.3K ohm ± 5%, ¼W	R-1261
R11	Resistor, Composition, 33K ohm ± 5%, ¼W	R-1285
R12	Resistor, Composition, 5.6K ohm ± 5%, ¼W	R-1267

TABLE 6

Loop Filter Board Assemblies A5A2/A10A2, Parts List (for -0520, -0560, -0580, and -0590) (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
R13	Resistor, Carbon Film, 4.3K ohm ± 2%, ¼W	R60-0002-073
R14	Resistor, Carbon Film, 1.3K ohm ± 2%, ¼W	R60-0002-060
R15	Resistor, Carbon Film, 4.3 ohm ± 2%, ¼W	R60-0002-073
R16 (-0520)	Resistor, Carbon Film, 20K ohm ± 2%, ¼W	R60-0002-089
R16 (-0560)	Resistor, Carbon Film, 6.2K ohm ± 2%, ¼W	R60-0002-077
R16 (-0580)	Resistor, Carbon Film, 20K ohm ± 2%, ¼W	R60-0002-089
R16 (-0590)	Resistor, Carbon Film, 6.2K ohm ± 2%, ¼W	R60-0002-077
R17	Resistor, Composition, 15K ohm ± 5%, ¼W	R-1277
R18	Resistor, Carbon Film, 2.7K ohm ± 2%, ¼W	R60-0002-068
R19	Resistor, Carbon Film, 5.1K ohm ± 2%, ¼W	R60-0002-075
R20 (-0520)	Resistor, Carbon Film, 180 ohm ± 2%, ¼W	R60-0002-039
R20 (-0560)	Resistor, Carbon Film, 1.1K ohm ± 2%, ¼W	R60-0002-058
R20 (-0580)	Resistor, Carbon Film, 180 ohm ± 2%, ¼W	R60-0002-039
R20 (-0590)	Resistor, Carbon Film, 1.1K ohm ± 2%, ¼W	R60-0002-058
R21 (-0520)	Not Used	
R21 (-0560)	Resistor, Composition, 33K ohm ± 2%, ¼W	R60-0002-094
R21 (-0580)	Not Used	
R21 (-0590)	Resistor, Composition, 33K ohm ± 2%, ¼W	R60-0002-094

TABLE 6

Loop Filter Board Assemblies A5A2/A10A2, Parts List (for -0520, -0560, -0580, and -0590) (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
R22 (-0520)	Resistor, Carbon Film, 16K ohm ± 2%, ¼ W	R60-0002-087
R22 (-0560)	Resistor, Carbon Film, 33K ohm ± 2%, ¼ W	R60-0002-094
R22 (-0580)	Resistor, Carbon Film, 16K ohm ± 2%, ¼ W	R60-0002-087
R22 (-0590)	Resistor, Carbon Film, 33K ohm ± 2%, ¼ W	R60-0002-094
R23	Resistor, Composition, 0.1 Meg ohm ± 5%, ¼ W	R-1297
R24	Resistor, Composition, 5.6K ohm ± 5%, ¼ W	R-1267
R25	Resistor, Composition, 2.7K ohm ± 5%, ¼ W	R-1259
R26	Potentiometer, Cermet, 10K ohm	R-2209
R27	Resistor, Composition, 1.1K ohm 5%, ¼ W	R-1250
TP1	Tip Jack, Red	J-0066

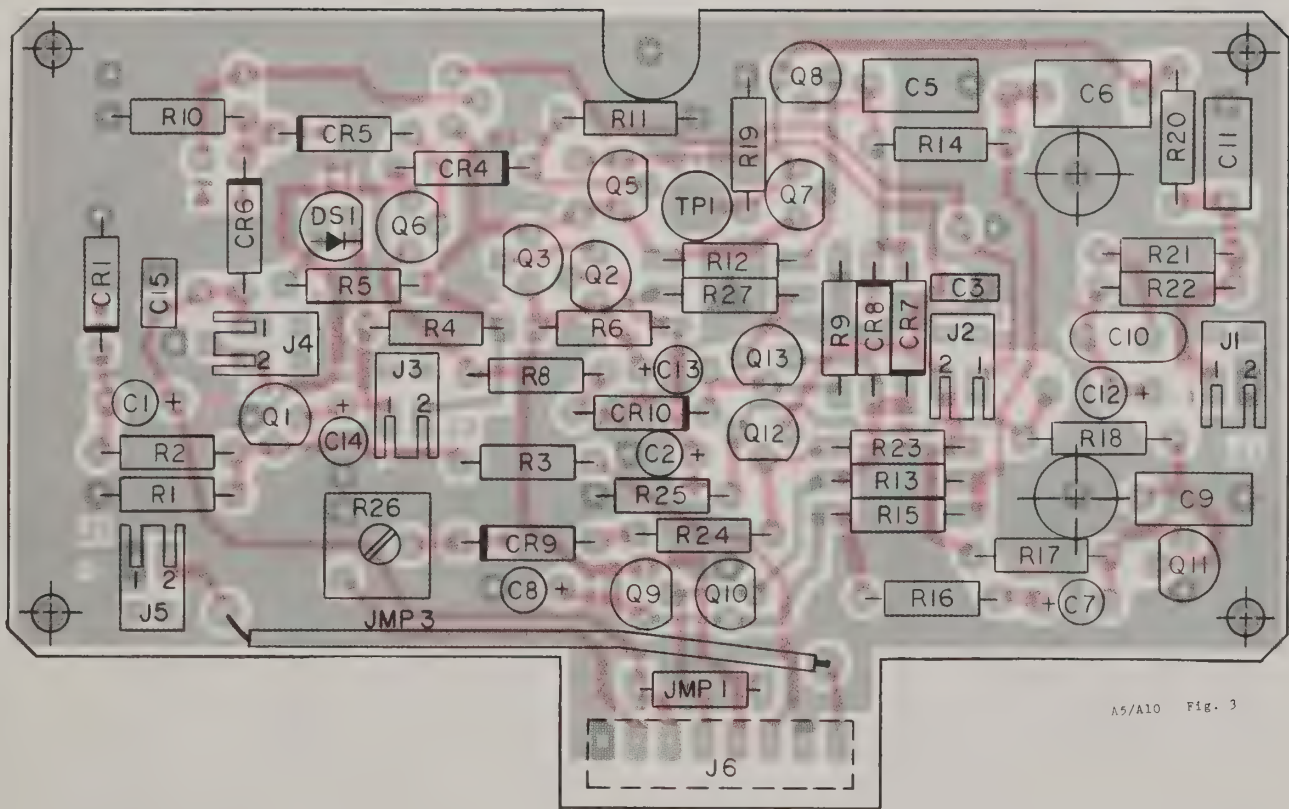


TABLE A

COMP DESIG.	USED ON UHF 10029-0520 10029-0580	USED ON VHF 10029-0560 10029-0590
R21 C10	OUT	IN

TABLE B

JMP 1		
10029-0580 10029-0590	OUT	TRANS
10029-0520 10029-0560	IN	RCV

NOTE:

1. ALL COMPONENTS ARE TO BE FULLY SEATED TO THE PCB SURFACE WITH EXCEPTION OF THE TRANSISTORS & TANTALUM CAPACITORS. MAX HEIGHT OF THE XSISTORS & TANTALUM CAPACITORS FROM THE PCB SURFACE IS TO BE 5/16"

NOTE:

- **COMPONENTS SHOWN IN SOLID BLACK**
- **FACING SIDE FOIL SHOWN IN BLACK SCREEN**
- **OPPOSITE SIDE FOIL SHOWN IN RED SCREEN**

Figure 4. Loop Filter Board Assembly A5A2/A10A2, Component Location Diagram

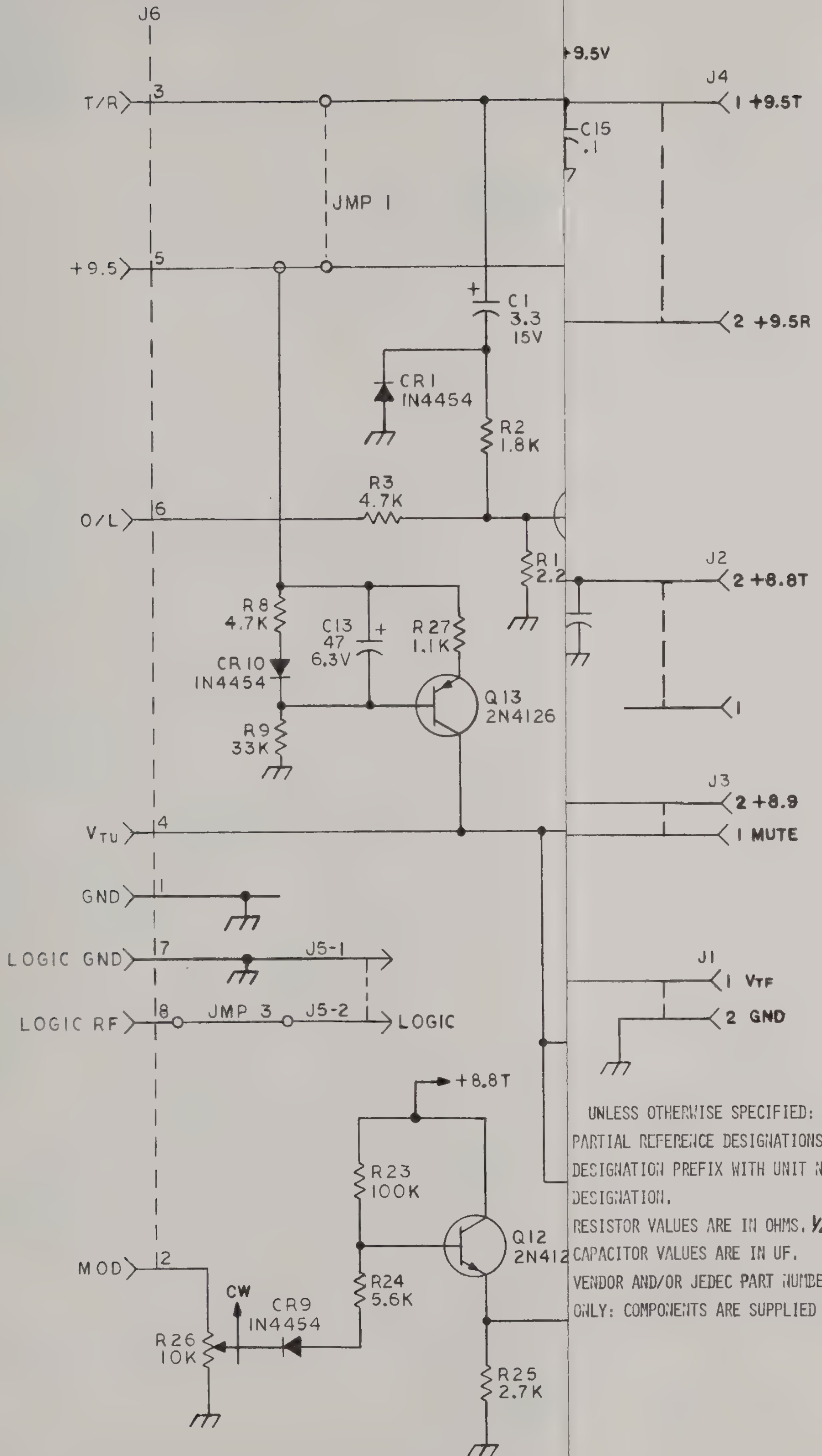


TABLE B		
JMP 1		
10029-0580 10029-0590	OUT	TRANS
10029-0520 10029-0560	IN	RCV

TABLE A		
	USED ON	
COMP DESIG.	UHF 10029-0580 10029-0520	VHF 10029-0590 10029-0560
R20	180	1.1K
R21	—	33K
R22	16K	33K
C10	—	1100PF
C11	.1	.033
R16	20K	6.2K

UNLESS OTHERWISE SPECIFIED:

PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER AND/OR ASSEMBLY DESIGNATION.

RESISTOR VALUES ARE IN OHMS, 1/4 WATT, 5%

CAPACITOR VALUES ARE IN UF.

VENDOR AND/OR JEDEC PART NUMBER CALLOUTS ARE FOR REFERENCE ONLY: COMPONENTS ARE SUPPLIED PER PART NUMBER IN PARTS LIST.

Figure 5. Loop Filter Board Assembly A5A2/A10A2, Schematic Diagram

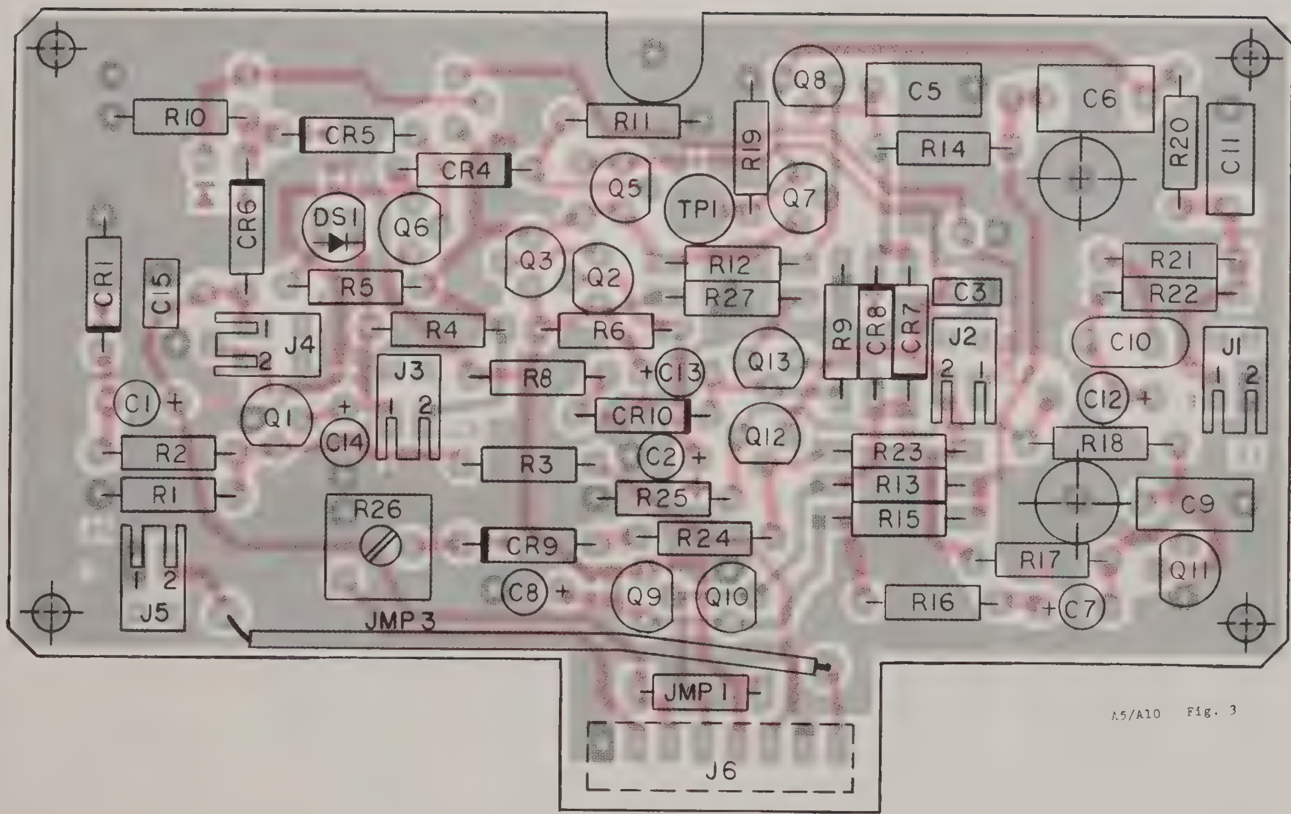


TABLE A		
COMP DESIG.	USED ON	
	UHF 10029-0520 10029-0580	VHF 10029-0560 10029-0590
R21 C10	OUT	IN

TABLE B		
JMP 1		
10029-0580 10029-0590	OUT	TRANS
10029-0520 10029-0560	IN	RCV

NOTE:

1. ALL COMPONENTS ARE TO BE FULLY SEATED TO THE PCB SURFACE WITH EXCEPTION OF THE TRANSISTORS & TANTALUM CAPACITORS. MAX HEIGHT OF THE XSISTORS & TANTALUM CAPACITORS FROM THE PCB SURFACE IS TO BE 5/16"

NOTE:
- COMPONENTS SHOWN IN SOLID BLACK
- FACING SIDE FOIL SHOWN IN BLACK SCREEN
- OPPOSITE SIDE FOIL SHOWN IN RED SCREEN

Figure 4. Loop Filter Board Assembly A5A2/A10A2, Component Location Diagram

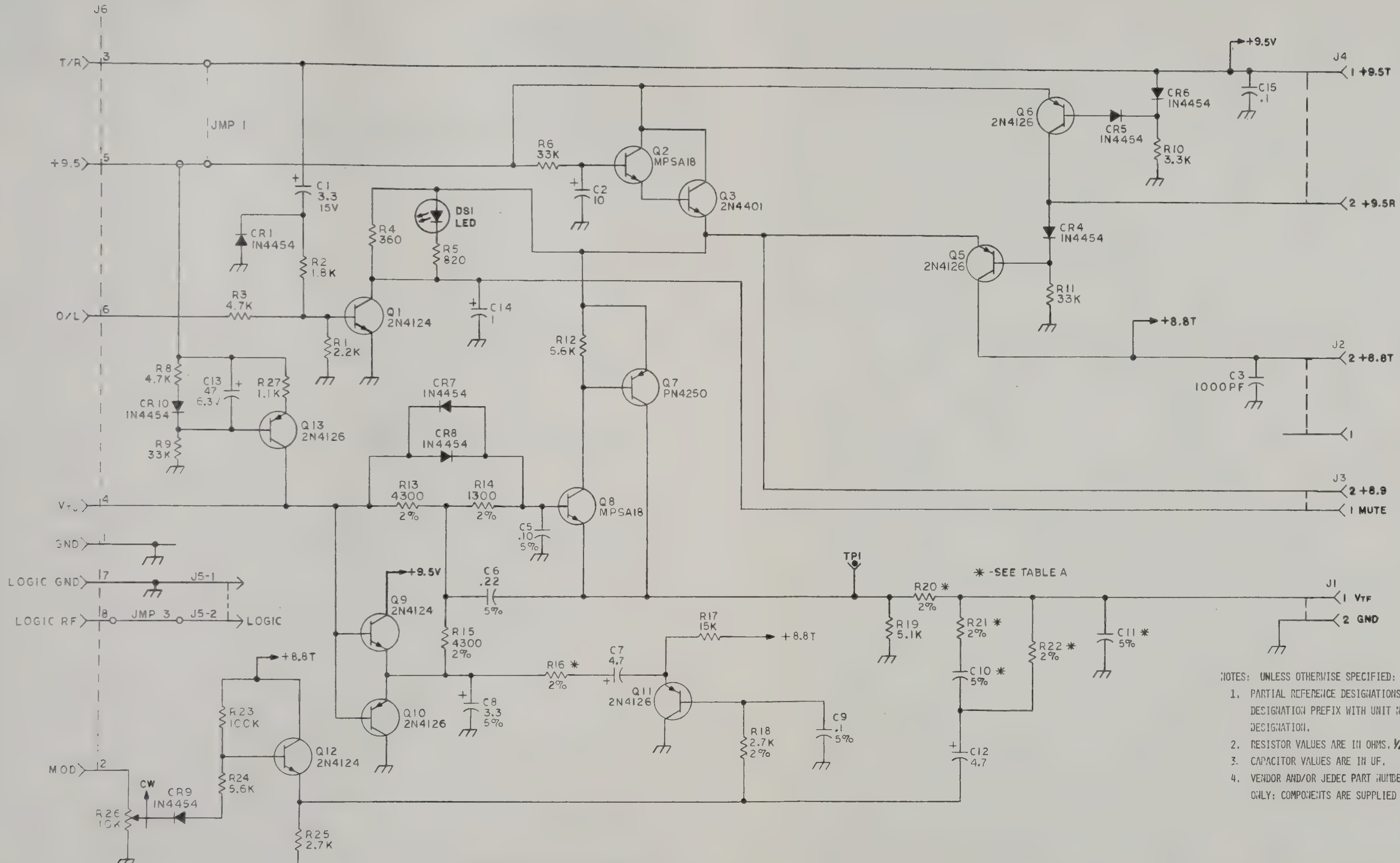


TABLE B		
	JMP 1	
10029-0580 10029-0590	OUT	TRANS
10029-0520 10029-0560	IN	RCV

TABLE A		
	USED ON	
COMP DESIG.	UHF 10029-0580 10029-0520	VHF 10029-0590 10029-0560
R20	180	1.1K
R21	—	33K
R22	16K	33K
C10	—	1100PF
C11	.1	.033
R16	20K	6.2K

NOTES: UNLESS OTHERWISE SPECIFIED:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER AND/OR ASSEMBLY DESIGNATION.
2. RESISTOR VALUES ARE IN OHMS. 1/4 WATT, 5%
3. CAPACITOR VALUES ARE IN UF.
4. VENDOR AND/OR JEDEC PART NUMBER CALLOUTS ARE FOR REFERENCE ONLY: COMPONENTS ARE SUPPLIED PER PART NUMBER IN PARTS LIST.

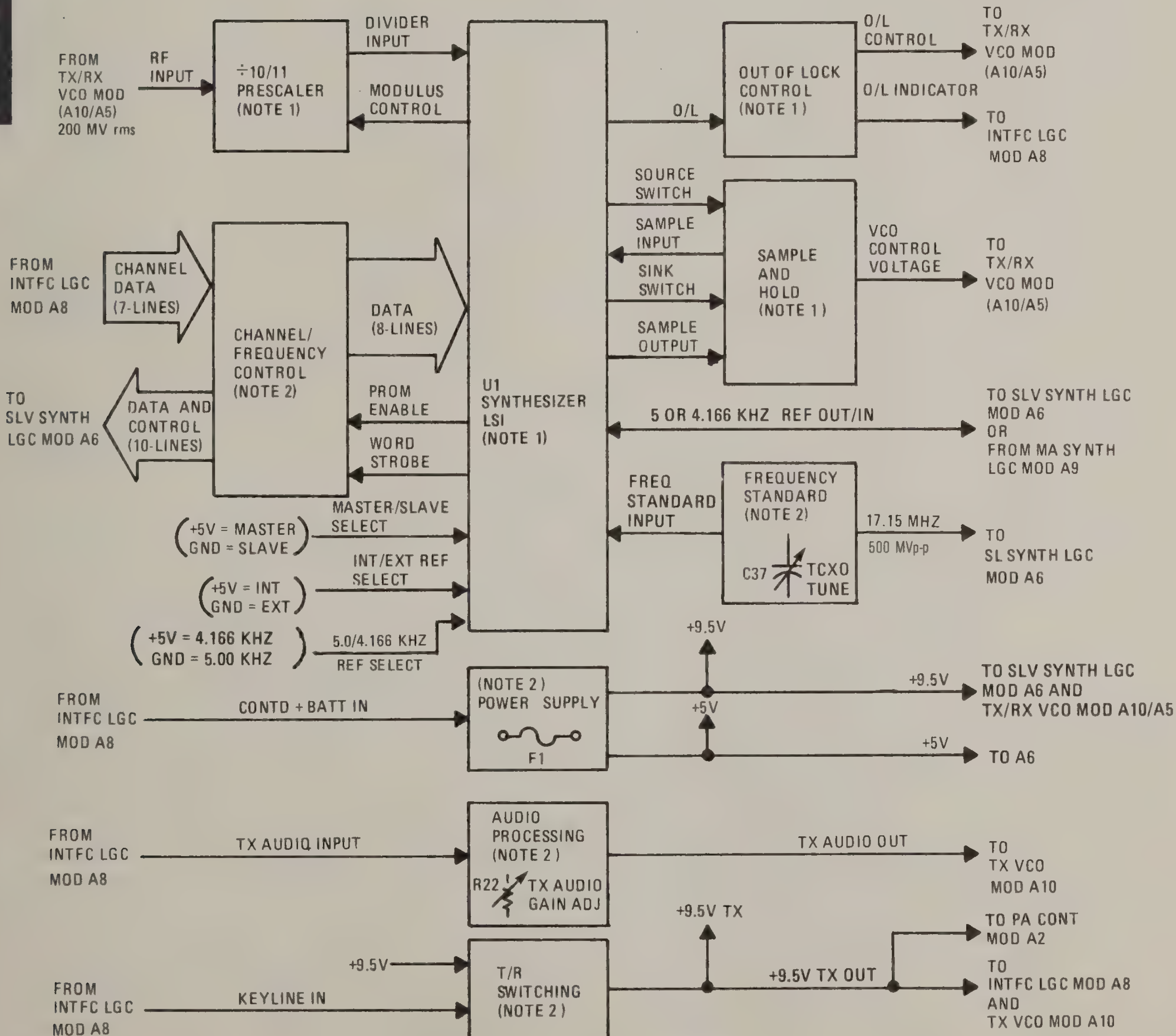
HIGHEST REFERENCE DESIGNATION				
C15	CR10	JMP 3	R28	Q13
REFERENCE DESIGNATION NOT USED				
JMP 2	CR 2		R 7	
	CR 3			

Figure 5. Loop Filter Board Assembly A5A2/A10A2, Schematic Diagram

A6/A9

SL/MA SYNTH LGC MOD

MASTER (UHF): 10029-0900/0920
MASTER (VHF): 10029-0910/0930
SLAVE: 10029-0600



NOTES:

1. COMMON TO BOTH A6 AND A9
2. USED ON A9 ONLY

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1. GENERAL DESCRIPTION

1.01 The major Master/Slave Synthesizer Logic Module functions are shown in the tab section cover diagram and in figure 1. Both Master Synthesizer Logic Module A9 and Slave Synthesizer Logic Module A6 perform three similar functions in the transmit and receive portions of the Transceiver. These functions are Prescaling, Out-of-Lock generation, and Sample and Hold.

1.02 Each module has a divide-by-ten/eleven prescaler to divide their respective VCO signals down to the frequency range processed by the Synthesizer Large Scale Integrated circuit (LSI) in each module. Each of the LSI's are identical and perform the fixed reference division and variable VCO division and comparison of these divided signals to generate the VCO control voltages and out-of-lock signals for the transmit and receive synthesizer loops.

1.03 The Master Synthesizer Logic Module also contains the Frequency Standard circuit that generates a 17.15 MHz reference frequency for both modules. Power supply regulators which provide +9.5 V and +5 V to both modules are also located on the Master Synthesizer.

1.04 The Master Synthesizer Logic Module also interfaces with Interface Logic Module A8 and contains the Channel Frequency Control circuit. The Channel Frequency Control circuit contains a PROM programmed with information that determines the division ratios in the Master and Slave LSI's which ultimately determines the transmit and receive frequencies.

1.05 The Master Synthesizer Logic Module also contains the modulation limiter and pre-and post-limiter filters used in the transmit audio processing circuit. Transmit control and audio signals originating in the Control Unit are connected to the T/R switching circuit on the Master Synthesizer Logic Module via the Interface Logic Module.

2. INTERFACE CONNECTIONS

A. General Information

2.01 UHF and VHF interface connections for the the Synthesizer Logic modules are identical. As previously described, the primary functions of both the Master and the Slave Synthesizer Logic Modules are identical, but the Master Synthesizer Logic Module provides interface between both Synthesizer Logic Modules and the Control Unit via the Interface Logic Board Module.

B. Master Synthesizer Logic Module Interface Connections

2.02 Table 1 summarizes all of the interface connections for the Master Synthesizer Logic Module.

TABLE 1

Master Synthesizer Logic Module, Interface Summary

REF DESIG	FUNCTION	TO	FROM
J1-1	Spare	A8J2-12	—
J1-2	(Key)	—	—
J1-3	Gnd	—	A8J2-10
J1-4	TELCO/$\overline{\text{RCC}}$ Channel Data In	—	A8J2-9
J1-5	VHF/$\overline{\text{UHF}}$ Channel Data In	—	A8J2-8
J1-6	E Channel Data In	—	A8J2-7
J1-7	D Channel Data In	—	A8J2-6
J1-8	C Channel Data In	—	A8J2-5
J1-9	B Channel Data In	—	A8J2-4
J1-10	A Channel Data In	—	A8J2-3
J1-11	O/L Out	A8J2-2	—
J1-12	Not Used	A8J2-1	—
J2-1	+9.5 Tx Out	A8J2-18	—
J2-2	(Key)	—	A8J2-17
J2-3	Gnd	—	A8J2-16
J2-4	Tx Key In	—	A8J2-15

TABLE 1

Master Synthesizer Logic Module, Interface Summary (Cont.)

REF DESIG	FUNCTION	TO	FROM
J2-5	Tx Audio In	—	A8J2-14
J2-6	Ctrl +Batt In	—	A8J2-13
J3-1	17.15 MHz Out	A6J2-18	—
J3-2	Gnd	A6J2-17	—
J3-3	O/L In	—	A6J2-16
J3-4	Ref Out	A6J2-15	—
J3-5	B1 ÷ N Data Out	A6J2-14	—
J3-6	B2 ÷ N Data Out	A6J2-13	—
J3-7	B3 ÷ N Data Out	A6J2-12	—
J3-8	B4 ÷ N Data Out	A6J2-11	—
J3-9	B5 ÷ N Data Out	A6J2-10	—
J3-10	B6 ÷ N Data Out	A6J2-9	—
J3-11	B7 ÷ N Data Out	A6J2-8	—
J3-12	B8 ÷ N Data Out	A6J2-7	—
J3-13	Word Strobe In	—	A6J2-6
J3-14	PROM Enable In	—	A6J2-5
J3-15	(Key)	—	—
J3-16	Ref Select Out	A6J2-3	—
J3-17	+5.0V Out	A6J2-2	—
J3-18	+9.5V Out	A6J2-1	—
J4-1	Gnd	A10P2-1	—
J4-2	Tx Audio Out	A10P2-2	—
J4-3	+9.5V Tx Out	A10P2-3	—

TABLE 1 (Cont.)

REF DESIG	FUNCTION	TO	FROM
J4-4	Tx VCO Ctrl Out	A10P2-4	—
J4-5	+9.5V Out	A10P2-5	—
J4-6	O/L Out	A10P2-6	—
J4-7	Rf Gnd	—	A10P2-7
J4-8	Tx VCO Rf In	—	A10P2-8

C. Slave Synthesizer Logic Module, Interface Connections

2.03 Table 2 summarizes all of the interface connections for the Slave Synthesizer Logic Module.

TABLE 2

Slave Synthesizer Logic Module, Interface Summary

REF DESIG	FUNCTION	TO	FROM
J1-1	Gnd	—	A5P2-1
J1-2	Not Used	—	—
J1-3	Not Used	—	—
J1-4	Rx VCO Ctrl Out	A5P2-4	—
J1-5	+9.5V Out	A5P2-5	—
J1-6	O/L Out	A5P2-6	—
J1-7	RF Gnd	—	A5P2-7
J1-8	Rx VCO Rf In	—	A5P2-8
J2-18	17.15 MHz In	—	A9J3-1
J2-17	Gnd	—	A9J3-2

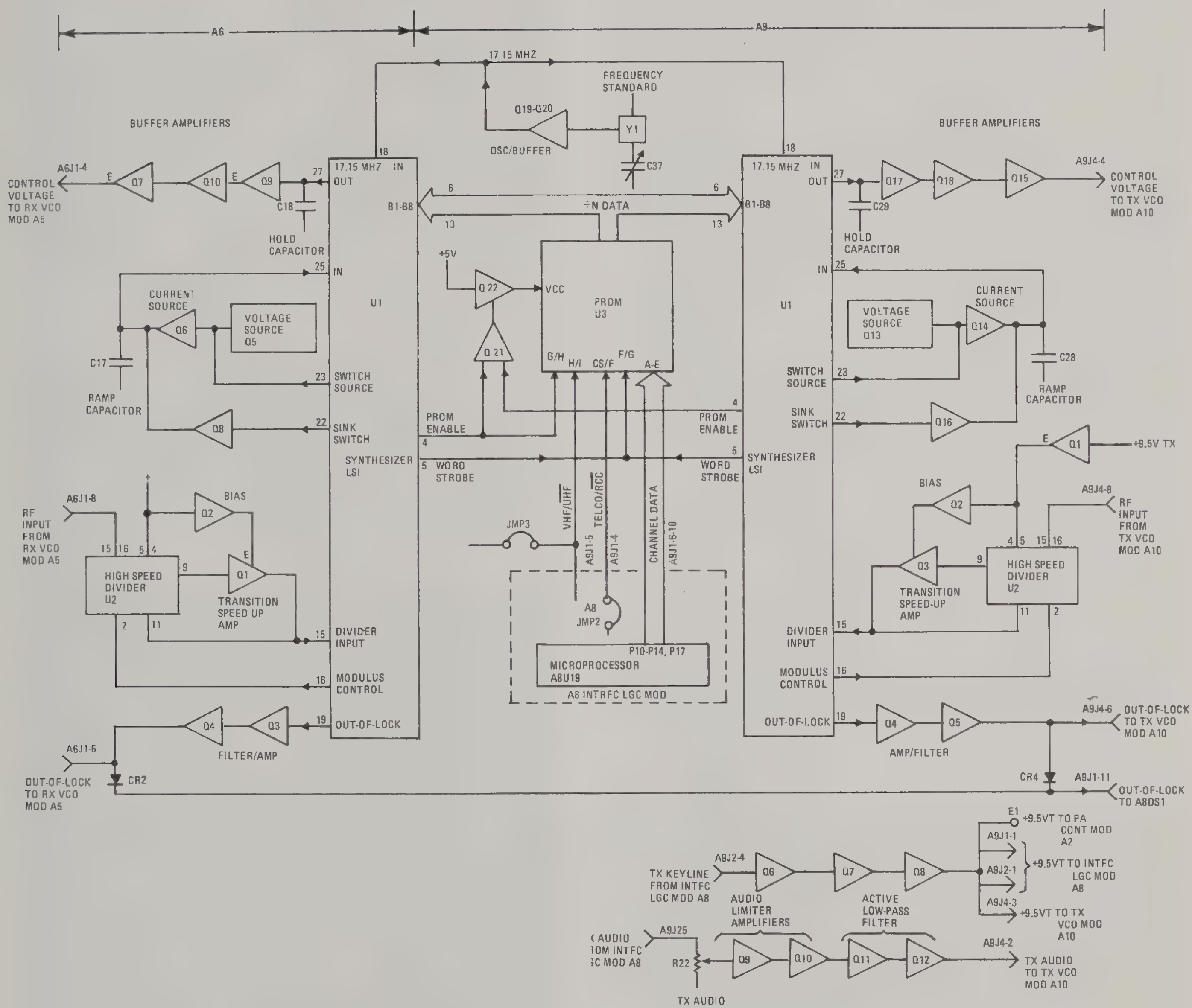


Figure 1. Master/Slave Synthesizer Logic Module, Simplified Diagram

TABLE 2

Slave Synthesizer Logic Module, Interface Summary (Cont.)

REF DESIG	FUNCTION	TO	FROM
J2-16	O/L Out	A9J3-3	—
J2-15	Ref Freq In	—	A9J3-4
J2-14	B1 ÷ N Data In	—	A9J3-5
J2-13	B2 ÷ N Data In	—	A9J3-6
J2-12	B3 ÷ N Data In	—	A9J3-7
J2-11	B4 ÷ N Data In	—	A9J3-8
J2-10	B5 ÷ N Data In	—	A9J3-9
J2-9	B6 ÷ N Data In	—	A9J3-10
J2-8	B7 ÷ N Data In	—	A9J3-11
J2-7	B8 ÷ N Data In	—	A9J3-12
J2-6	Word Strobe Out	A9J3-13	—
J2-5	PROM Enable Out	A9J3-14	—
J2-4	(Key)	N/A	N/A
J2-3	Ref Select In	—	A9J3-16
J2-2	+5.0V In	—	A9J3-17
J2-1	+9.5V In	—	A9J3-18

3. SUPPLEMENTARY SEMICONDUCTOR DATA

A. Master/Slave Synthesizer Logic Module

3.01 Supplementary semiconductor data for the Master and Slave Synthesizer Logic Modules are included in Chapter 4, Maintenance, for the complex devices listed in table 3.

TABLE 3

Master/Slave Synthesizer Logic Modules, Complex Semiconductor Devices

REF DESIG	DEVICE TYPE	FUNCTION	PAGE
A9U1	HSD3252	LSI Synthesizer	
A9U2	SP8647B	High Speed Divider	
A9U3	10029-0997	PROM	
A9U4	LM240LAZ5.0	5 Volt Regulator	
A6U1	HSD3252	LSI Synthesizer	
A6U2	SP8690B	High Speed Divider	

4. TECHNICAL DESCRIPTION

A. Master Synthesizer Logic Module

Programming Jumpers

4.01 The Master Synthesizer Logic Modules perform almost identical functions. The only difference between the 10029-0900 UHF module and the 10029-0910 VHF module is the addition or deletion of (jumpers) JMP2 and JMP3. For VHF operation, JMP2 is included to pull down to ground pin 3 of LSI U1, selecting the 5 kHz reference which allows the VCO to move in 5 kHz steps. JMP3 is excluded to allow 5 volts on pin 19 of PROM U3 to select stored VHF channels. During UHF operation, JMP2 is excluded to allow +5 volts on pin 3 of LSI U1, thereby selecting the $4.16\overline{6}$ kHz reference. This allows the VCO to move in $4.16\overline{6}$ kHz steps, which becomes 12.5 kHz steps when tripled. JMP3 is included to pull down pin 19 of PROM U3 to ground to select stored UHF channels. When JMP2 and JMP3 are not installed, U1-3 is pulled up by resistor A9R9 and U3-19 is pulled up by resistor A8R98.

Channel Frequency Control

4.02 The Channel Frequency Control circuit receives five lines of binary code address information (Lines A through Lines E) from the Interface Logic Module which represents the channel selected. These lines, plus the VHF/$\overline{\text{UHF}}$ signal line and the TELCO/$\overline{\text{RCC}}$ signal lines, address the proper channel data in PROM U3.

4.03 Transistors Q21 and Q22 enable PROM U3 whenever the PROM Enable signal from Master LSI U1-4 or when the PROM Enable signal from Slave LSI U1-4 is applied to the base of switch Q21. This causes Q21 to conduct providing a base current path for switch Q22. Transistor switch Q22 conducts applying + 5 volts supply to U3-20. Whenever PROM U3 is enabled by the Slave LSI A6U1, the PROM Enable signal is also applied to G/H select pin U3-18 to select the receive channel data stored in the PROM. When U3-18 is LOW, transmit channel data is selected.

4.04 Since the Master LSI A9U1, the Slave LSI A6U1, and the PROM A9U3, all share the same divider data lines (B1 through B8), clock signals derived by Master LSI A9U1, from the reference signal, are used to control the Master and Slave LSI's so that they alternately look at the PROM divider data lines even though the PROM data is presented to both A9U1 and A6U1 in parallel. Synchronization of the two LSI's is controlled by the Master LSI. The REF OUT signal A9U1-21 provides a clock signal to the Slave LSI that is 180° out of phase from the Master LSI clock, thus all Slave LSI operations are one-half clock cycle apart from the Master LSI operations. PROM Data is read into the appropriate LSI when its PROM Enable line is High (either A9U1-4 or A6U1-4). The ÷ N information for each frequency is stored in the PROM as two 8-bit words. Every reference cycle (240 μsec for the $4.\overline{16}$ kHz reference, and 200 μsec for the 5 kHz reference) the PROM Enable line (U1-4) goes High for 2.0 μsec to read the ÷ N information from the PROM (see figure 2). For the first half of the PROM Enable pulse, the Word Strobe signal (U1-5) is High and selects the least significant word by addressing the PROM at A9U3-17. When the Word Strobe signal goes Low for the second half of the PROM Enable signal, the most significant word is presented to the appropriate LSI.

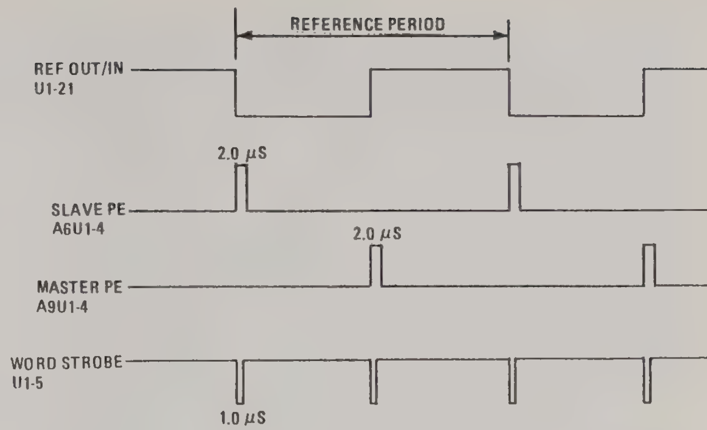


Figure 2. LSI Timing

Variable Modulus High Speed Divider

4.05 The Transmit VCO RF Input signal is fed to the input of Dual Modulus High Speed Divider U2-16 through a bandpass filter. The divider normally divides by ten, but periodically divides by 11 when called for by Modulus Control signal (U1-16) going Low. Transistor Q3 forms an active pull up circuit in the divider that functions as a transition speed-up amplifier network. The ECL outputs at U2-9 are fast, but are not of a sufficient level to drive Divider Input U1-15. The active pull up circuit is used to speed up the TTL compatible output at U2-11. Divider (U2) is switched on by transistor Q1 during transmit only. Transistor Q2 provides bias compensation for the output level converter Q3. The Modulus Control signal output from A9U1-16 makes the Prescaler act like a Swallow Counter thus allowing TX VCO Module A10 to move in 5.0 kHz (VHF) or 12.5 kHz (UHF) steps as measured at the A7J2 Exciter output.

Sample and Hold

4.06 Transistors Q13 and Q14, of the Sample and Hold circuit, work in conjunction with the Source Switch output at U1-23 to provide a constant current source used to charge ramp capacitor C28. The charge cycle is initiated by a timing signal in the LSI that is derived from the reference frequency. Another timing signal in the LSI that is derived from the divided VCO signal halts the rising voltage on ramp capacitor C28 for a brief period and causes the voltage to be transferred to hold capacitor C29 via the LSI Sample Input at U1-25 and the LSI Sample Output at U1-27. Transistors Q17, Q18, and Q15 act as buffer amplifiers for the voltage on the hold capacitor to produce a Control Voltage

signal output at J4-4 to Tx VCO Module. After the ramp and hold voltage transfer, the voltage on the sample capacitor continues to rise until the next timing signal (derived from the reference frequency) called the Sink Switch output at U1-22, causes the ramp capacitor to discharge through resistor R46 and transistor Q16. Once this occurs the next cycle can begin. Due to the combination of signals at the ramp capacitor it is a very useful test point.

4.07 Any tendency for the Tx VCO Module to wander in frequency will result in a correcting shift of the sample level, thus producing a change in the voltage on hold capacitor C29. This shifted control voltage is of the proper sense and amplitude to synchronize the Tx VCO Module with the reference frequency. Since the VCO is designed for good short term stability, the cycle-to-cyle shifts are minimized.

O/L Detector

4.08 Transistors Q4 and Q5 form an active amplifier/filter network in the Out-of-Lock circuit to integrate and amplify the Out-of-Lock pulses (U1-19) present during an unlocked condition of the Tx VCO. The resultant Out-of-Lock signals are used to control the Tx VCO Module and is ORed with the Slave Out-of-Lock signal to control the Out-of-Lock indicator A8DS1.

Tx Audio

4.09 Tx Audio Gain Adjust potentiometer A9R22 sets the input level for proper clipping. The Tx Audio Input signals are limited by differential amplifier Q9-Q10. Capacitor A8C19 with resistor A9R22 and capacitor A9C14 with resistors A9R24 and A9R25 provide two poles of the high pass (f_C = 175 Hz) filter. Transistors Q11 and Q12 form a 4-pole active low pass (f_C ≅ 3000 Hz) filter to provide the post-limiter roll off required by FCC rules.

Frequency Standard

4.11 Transistors Q19 and Q20 and crystal Y1 form a high stability network in the Frequency Standard at 17.15 MHz. The reference frequency is determined by temperature compensated quartz crystal network Y1. The crystal, a thermistor, and a compensation capacitor are housed in a sealed metal container and installed as a component on the Master Synthesizer Logic Module. Either a ± 2 PPM or a ± 5 PPM (normally used) assembly may be installed interchangeably to meet customer requirements. TCXO Tune trimmer capacitor C37 is used to set the oscillator to the exact crystal frequency required.

Tx Control

4.12 Transmit Keyline switch Q6, Auxiliary Keyline switch Q7, and TX/RX switch Q8 supply +9.5V Tx to Master Synthesizer Logic Module A9, Tx VCO Module A10, and PA Control Module A2 in response to a signal from the Interface Logic Module. When the Keyline In (A9J2-4) signal goes low, Transmit Keyline switch Q6 conducts, turning on Q7 which pulls the base of TX/RX switch Q8 low. This causes Q8 to conduct making the +9.5V Tx available to activate transmit circuits at A2E1, A10J4 (pin 3), and Master High Speed Divider A9U2 via A9Q1.

Miscellaneous

4.13 Transistor A9Q23 and integrated circuit A9U4, +9.5 V regulator and +5.0 V regulator, respectively, are used in both the Master and Slave Synthesizer Logic Modules. The A9U1 LSI is predetermined as the Master LSI by tieing the Master/Slave select input A9U1-2 and the Ref Int/Ext Select input A9U1-24 to +5 V.

B. Slave Synthesizer Logic Module

General

4.14 The Large Scale Integrated (LSI) circuits on both the Master and Slave modules are identical and thus perform identical functions for the transmit and receive synthesizer loops. The Slave Synthesizer Logic Module performs the same type of frequency control function in the receive loop of the synthesizer as the Master Synthesizer Logic Module performs in the transmit loop. Power supply, divider information and reference signals are supplied to the Slave module by the Master module. Separate memory locations for receive and transmit division ratios in PROM A9U3 allow independent control of receive and transmit frequencies.

4.15 The 17.15 MHz frequency signal developed by the Frequency Standard circuit on the Master Synthesizer Module is routed to 17.15 MHz signal pin 18 of LSI A9U1. Slave Ref Freq

Select Pin A6U1-3 is tied directly to Master Select Pin A9U1-3, to ensure that both synthesizers move in the same steps. LSI A6U1 is predetermined as the Slave LSI by tieing Master/SLAVE select input U1-2 and the REF INT/EXT SELECT U1-24 input to ground.

Channel Frequency Control

4.16 Since both the Master and the Slave LSI's share the same divider data lines (B1 through B8) from PROM A9U3, the clock signals developed on the Master Synthesizer Module control which LSI will address and read the PROM. When the Slave LSI addresses PROM A9U3, the PROM Enable signal A6U1-4 and the Word Strobe signal A6U1-5 are routed to the Channel/Frequency Control circuit on the Master Synthesizer Module to power up the PROM and select the proper data. The divider data bits (B1 through B8) are then inputted to LSI A6U1 pins 6 through 11. (See Section 4.04 for more details.)

Variable Modulus High Speed Divider

4.17 The receive VCO rf input signal is fed to the input of Dual Modulus High Speed Divider U2-16 through a bandpass filter. The divider normally divides by ten, but periodically divides by 11 when called for by Modulus Control signal (U1-16) going Low. Transistor Q1 forms an active pull up circuit in the divider that functions as a transition speed-up amplifier network. The ECL outputs at U2-9 are fast, but are not of a sufficient level to drive Divider Input U1-15. The active pull up circuit is used to speed up the TTL compatible output at U2-11. Transistor Q2 provides bias compensation for the output level converter Q1. The Modulus Control signal output from U1-16 makes the Prescaler act like a Swallow Counter thus allowing Rx VCO Module A5 to move in 5.0 kHz (VHF) of $4.16\overline{6}$ kHz (UHF) steps.

O/L Detector

4.18 Transistors Q3 and Q4 form an active amplifier/filter network in the Slave Out-of-Lock circuit to amplify the Slave Out-of-Lock pulses (U1-19) present when the Rx VCO Module is in an unlocked condition. The resultant Slave Out-of-Lock signals are used to control the Rx VCO Module and are ORed with the Master (Transmit) Out-of-Lock signal on the Master Synthesizer Module to control Out-of-Lock indicator A8DS1.

Sample and Hold

4.19 Transistors Q5 and Q6, in the Slave Sample and Hold circuit, work in conjunction with the Source Switch output at U1-23 to provide a constant current source used to charge ramp capacitor C17. The charge cycle is initiated by a timing signal in the LSI that is derived from the reference frequency. Another timing signal that is derived from the divided VCO signal halts the rising voltage on ramp capacitor C17 for a brief period and causes the voltage to be transferred to hold capacitor C18 via LSI Sample Input U1-25 and LSI Sample Output U1-27. Transistors Q9, Q10, and Q7 act as buffer amplifiers for the voltage on the hold capacitor to produce Control Voltage signal output J1-4 for the Rx VCO Module. After the sample and hold voltage transfer, the voltage on the ramp capacitor continues to rise until the next timing signal (derived from the divided reference frequency), the Sink Switch output from U1-22, causes the ramp capacitor to discharge through resistor R21 and transistor Q8. Once this occurs the next cycle can begin. Due to the combination of signals at the ramp capacitor it is a very useful test point.

5. MAINTENANCE

A. General Information

5.01 All significant inputs and outputs are shown on the tab section cover diagram and in the schematic diagrams in this tab section. The adjustment indicated by the alignment procedures described in this section are made at the factory prior to shipment. Normally, it should not be necessary to repeat any of these adjustments unless there are component failures or unless changes in operating frequency are made. The Master and Slave Synthesizer Logic Module adjustments are made in conjunction with the Rx VCO Module, the Tx VCO Module and the Interface Logic Module adjustments. Removal of the Transceiver cover facilitates the maintenance and adjustment of the previously mentioned modules by making all necessary test points available. These adjustments can be made using the test equipment shown in figure 3 or their equivalents.

CAUTION

Always disconnect power when removing or installing subassemblies.

B. Synthesizer Tune Up (25°C)

(a) Confirm the correct position of jumper A9JMP3 on the Master Synthesizer Logic Module for desired operation (in for UHF, out for VHF) and also confirm that the correct code plug (PROM A8U16) is in the Interface Logic Module.

(b) Confirm correct position of reference select jumper A9JMP2 on the Master Synthesizer Module for 4.1667 kHz or 5 kHz reference, (in for 5 kHz VHF, out for 4.167 kHz UHF).

(c) Connect power and Control Unit cables according to figure 3. Set Control Unit for manual operation in center channel.

C. RX Tune Up

(a) If Transceiver is not locked, O/L indicator lamps A8DS1 and A5A2DS1 will be lit. If this is the case, adjust Rx VCO Adjust trimmer A5AIC14 until O/L indicator lamp is extinguished (or dim). Adjust A5A1C14 so that dc voltage measured at test point A5A2TP1 is +5.6 Vdc at center frequency.

(b) Check to ensure that all channels will lock up.

D. TX Tune Up

(a) Disconnect transmit power to the PA Module by disconnecting the cable from A1P1 to A7J2.

(b) The transmit tune up is similar to the receive tune up except for a long time delay between lock up and indication on O/L indicator lamps A8DS1 and A10A2DS1. Turning Tx VCO Adjust trimmer A10A1C14 at about ¼ of a turn per second, with Transmitter keyed, will allow lamp to extinguish before going out of range.

(c) Once O/L indicator lamps A8DS1 and A10A2DS1 are extinguished (or dim), adjust A10A1C14 so that dc voltage measured at test point A10A1TP1 is +5.6 Vdc at the center frequency.

(d) Reconnect input cable to the PA Module and output cable from the Tx Exciter Module.

(e) Set Control Unit to a known channel and connect a frequency counter to antenna connector J1 through a power attenuator. Key Transmitter. Adjust TXCO Tune trimmer A9C37 to the transmit channel frequency. This adjustment sets all Tx and Rx channels on frequency.

6. PARTS LIST

A. Master Synthesizer Logic Module

6.01 The Master Synthesizer Logic Module parts list information is given in table 4. Figure 4 gives the Master Synthesizer Logic Module component location information.

B. Slave Synthesizer Logic Module

6.02 The Slave Synthesizer Logic Module parts list information is given in table 5. Figure 6 gives the Slave Synthesizer Logic Module component location information.

7. SCHEMATIC DIAGRAMS

A. Master Synthesizer Logic Module

7.01 Figure 5 is the Master Synthesizer Logic Module schematic diagram.

B. Slave Synthesizer Logic Module

7.02 Figure 7 is the Slave Synthesizer Logic Module schematic diagram.

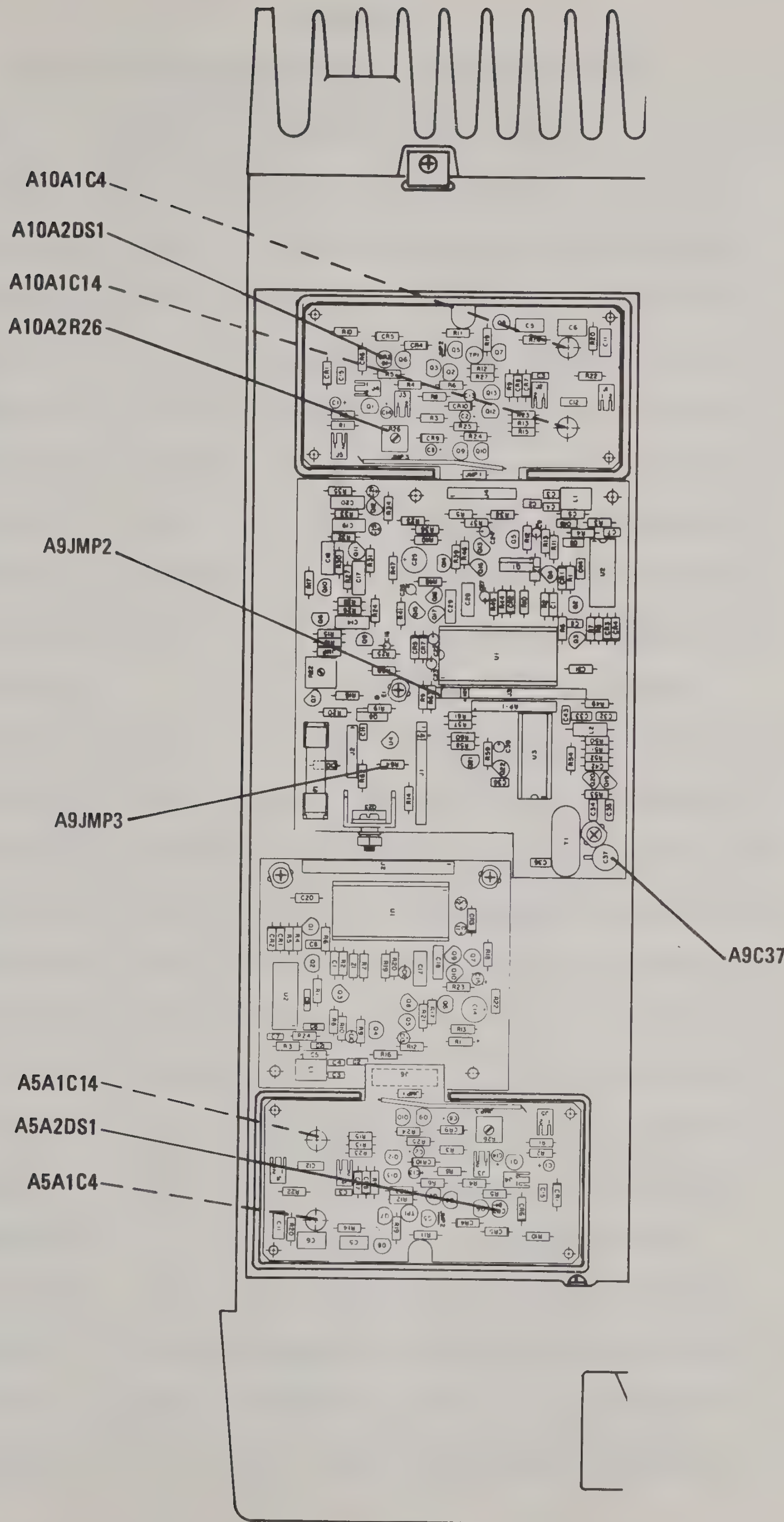


Figure 3. Master/Slave Synthesizer Logic Module, Adjustments

TABLE 4

Master Synthesizer Logic Module, Parts List

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
A9	MA SYNTH LGC MOD (UHF), 4.5 ppm	10029-0900
A9	MA SYNTH LGC MOD (UHF), 2 ppm	10029-0920
A9	MA SYNTH LGC MOD (VHF), 4.5 ppm	10029-0910
A9	MA SYNTH LGC MOD (VHF), 2 ppp	10029-0930
C1	Capacitor, Ceramic, axial, 1.8 pF	C12-0001-004
C2	Capacitor, Ceramic, 2700 pF	C11-0016-272
C3	Capacitor, Ceramic, 22 pF	C11-0015-220
C4	Capacitor, Ceramic, 12 pF	C11-0015-120
C5	Capacitor, Ceramic, axial, 1.8 pF	C12-0001-004
C6	Capacitor, Ceramic, 2700 pF	C11-0016-272
C7	Capacitor, Ceramic, 12 pF	C11-0015-120
C8	Capacitor, Ceramic, 1000 pF	C11-0016-102
C9	Capacitor, Tantalum, 4.7 μF, 20V	C-6446
C10	Capacitor, Ceramic, axial, 0.01 μF	C12-0001-056
C11	Capacitor, Ceramic, 1000 pF	C11-0016-102
C12	Not Used	
C13	Not Used	
C14	Capacitor, Mylar, 0.047 μF, 250V	10029-0958
C15	Capacitor, Electrolytic, 33 μF	C19-0002-033
C16	Capacitor, Tantalum, 4.7 μF, 20V	C-6446
C17	Capacitor, Mylar, 0.01 μF, 250V	C61-0001-107
C18	Capacitor, Mylar, 0.0047 μF, 250V	C61-0001-105
C19	Capacitor, Mylar, 0.022 μF, 250V	C61-0001-109
C20	Capacitor, Mylar, 0.001 μF, 250V	C61-0001-101

TABLE 4

Master Synthesizer Logic Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
C21	Capacitor, Tantalum, 6.8 μF, 35V	C-3102
C22	Capacitor, Tantalum, 22 μF, 20V	C-6450
C23	Capacitor, Tantalum, 22 μF, 20V	C-6450
C24	Capacitor, Tantalum, 47 μF, 6V	C25-0010-607
C25	Capacitor, Electrolytic, 470 μF	C19-0002-471
C26	Capacitor, Tantalum, 47 μF, 6V	C25-0010-607
C27	Capacitor, Tantalum, 1μF, 35V	C-6421
C28	Capacitor, Polypro, 0.1 μF	C60-0005-104
C29	Capacitor, Mylar, 0.027 μF	10029-0952
C30	Not used	
C31	Capacitor, Ceramic, axial, 150 pF	C12-0001-039
C32	Capacitor, Ceramic Monolithic, 68 pF	10029-0985
C33	Capacitor, Ceramic Monolithic, 240 pF	10029-0987
C34	Capacitor, Ceramic Monolithic, 110 pF	10029-0986
C35	Capacitor, Ceramic Monolithic, 110 pF	10029-0986
C36	Capacitor, Ceramic, 6.8 uF	C85-0007-101
C37	Capacitor, Trimmer, 2-10 pF	10029-0975
C38	Capacitor, Ceramic, 1000 pF	C11-0016-102
C39	Capacitor, Tantalum, 33 μF, 20V	C-6451
C40	Not used	
C41	Not used	
C42	Capacitor, Ceramic, axial, 0.01 μF	C12-0001-056
C43	Capacitor, Ceramic, 2700 pF	C11-0016-272
C44	Capacitor, Ceramic, 2700 pF	C11-0016-272

TABLE 4

Master Synthesizer Logic Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
C45	Capacitor, Ceramic, 2700 pF	C-11-0016-272
C46	Capacitor, Tantalum, 10 μF, 20V	C-6448
CR1	Diode, Signal, 1N4454	CR-0705
CR2	Diode, Signal, 1N4454	CR-0705
CR3	Diode, Switching, 1N6263	D10-6263-000
CR4	Diode, Signal, 1N4454	CR-0705
CR5	Diode	100029-0635
CR6	Not used	
CR7	Diode, Zener, 1N4732	D30-1047-957
E1	Connector Pin	MP-0287
F1	Fuse, 8AG, ½ ampere	F08-0001-004
J1	Connector, PCB, 12-circuit	J41-0001-112
J2	Connector, PCB, 6-circuit	J41-0001-004
J3	Connector, Male, 18-pin	J41-0002-018
J4	Connector, 8-pin	J41-0009-008
JMP1	Circuit Jumper	MP-1142
JMP2	Circuit Jumper, used on 0910 and 0930 assemblies only	MP-1142
JMP3	Circuit Jumper, used on 0900 and 0920 only	MP-1142
L1	Choke, molded, 0.077 μH	LO5-0001-007
L2	Choke, 1.5 μH	MS18130-10
Q1	Transistor, TIP41	Q-0056
Q2	Transistor, PN4258	Q-0153
Q3	Transistor, PN4258	Q-0153
Q4	Transistor, 2N4124	Q-0385

TABLE 4

Master Synthesizer Logic Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
Q5	Transistor, MPS-A64	Q-0410
Q6	Transistor, 2N4126	Q-0386
Q7	Transistor, 2N4124	Q-0385
Q8	Transistor, TIP42	Q-0044
Q9	Transistor, 2N4126	Q-0386
Q10	Transistor, 2N4126	Q-0386
Q11	Transistor, MPS-A64	Q-0410
Q12	Transistor, MPS-A64	Q-0410
Q13	Transistor, 2N4401	Q02-4401-000
Q14	Transistor, 2N4403	Q02-4403-000
Q15	Transistor, PN4250	Q22-0001-000
Q16	Transistor, 2N4401	Q02-4401-000
Q17	Transistor, PN4250	Q22-0001-000
Q18	Transistor, MPS-A18	Q25-0005-000
Q19	Transistor, MPS-6507	Q-0019
Q20	Transistor, MPS-6507	Q-0019
Q21	Transistor, 2N4124	Q-0385
Q22	Transistor, MPS-4354	Q25-0004-000
Q23	Transistor, D45C1	10029-0993
R1	Resistor, Composition, 1.5 K ohm ±5%, ¼ W	R-1253
R2	Resistor, Composition, 3.6 K ohm ±5%, ¼ W	R-1262
R3	Resistor, Composition, 1 K ohm ±5%, ¼ W	R-1249
R4	Resistor, Composition, 150 ohm ±5%, ¼ W	R-1229
R5	Resistor, Composition, 750 ohm ±5%, ¼ W	R-1246

TABLE 4

Master Synthesizer Logic Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
R6	Resistor, Composition, 10 ohm ±5%, ¼ W	R-1201
R7	Resistor, Composition, 12 K ohm ±5%, ¼ W	R-1275
R8	Resistor, Composition, 1.2 K ohm ±5%, ¼ W	R-1251
R9	Resistor, Composition, 30 K ohm ±5%, ¼ W	R-1284
R10	Resistor, Composition, 18 K ohm ±5%, ¼ W	R-1279
R11	Resistor, Composition, 560 ohm ±5%, ¼ W	R-1243
R12	Resistor, Composition, 30 K ohm ±5%, ¼ W	R-1284
R13	Resistor, Composition, 30 K ohm ±5%, ¼ W	R-1284
R14	Resistor, Composition, 30 K ohm ±5%, ¼ W	R-1284
R15	Resistor, Composition, 1 K ohm ±5%, ¼ W	R-1249
R16	Resistor, Carbon Film, 4.7 K ohm ±2%, ¼ W	R60-0002-074
R17	Resistor, Composition, 7.5 K ohm ±5%, ¼ W	R-1270
R18	Resistor, Composition, 2.7 K ohm ±5%, ¼ W	R-1259
R19	Resistor, Composition, 300 ohm ±5%, ¼ W	R-1236
R20	Resistor, Composition, 510 ohm ±5%, ¼ W	R-1242
R21	Not Used	
R22	Potentiometer, Cermet, 2 K ohm	R-2207
R23	Resistor, Composition, 470 ohm ±5%, ¼ W	R-1241
R24	Resistor, Metal Film, 39.2 K ohm ±1%, ¼ W	10029-0630
R25	Resistor, Metal Film, 39.2 K ohm ±1%, ¼ W	10029-0630
R26	Resistor, Carbon Film, 18 K ohm ±2%, ¼ W	R60-0002-088
R27	Resistor, Metal Film, 10 K ohm ±1%, ¼ W	10029-0626
R28	Resistor, Carbon Film, 39 K ohm ±2%, ¼ W	R60-0002-096
R29	Resistor, Metal Film, 20 K ohm ±1%, ¼ W	10029-0629

TABLE 4

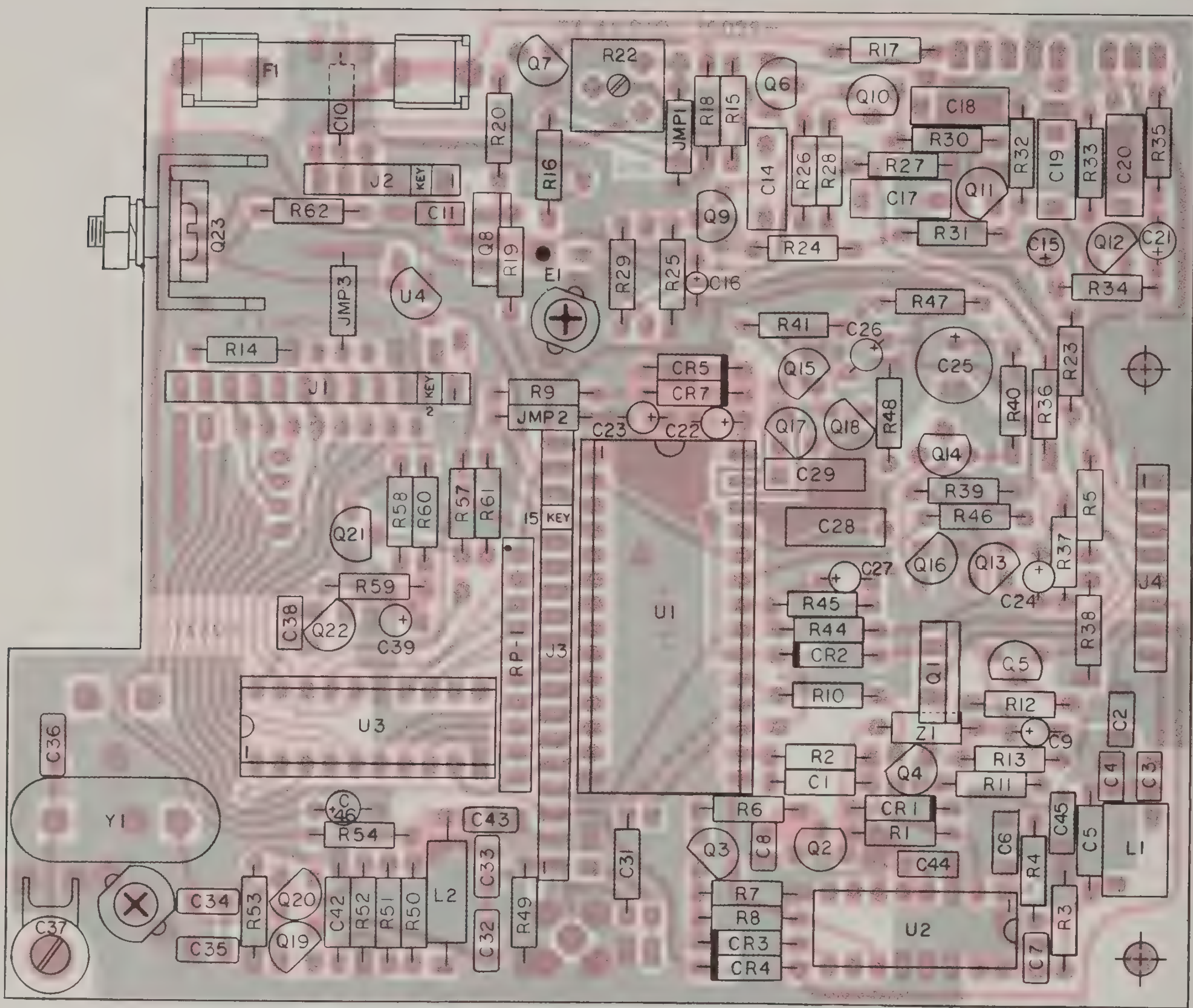
Master Synthesizer Logic Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
R30	Resistor, Metal Film, 15 K ohm ±1%, ¼ W	10029-0628
R31	Resistor, Composition, 4.7 K ohm ±5%, ¼ W	R-1265
R32	Resistor, Metal Film, 6.81 K ohm ±1%, ¼ W	10029-0625
R33	Resistor, Metal Film, 13 K ohm ±1%, ¼ W	10029-0627
R34	Resistor, Composition, 3.9 K ohm ±5%, ¼ W	R-1263
R35	Resistor, Composition, 1 K ohm ±5%, ¼ W	R-1249
R36	Resistor, Carbon Film, 150 ohm ±2%, ¼ W	R60-0002-037
R37	Resistor, Carbon Film, 3 K ohm ±2%, ¼ W	R60-0002-069
R38	Resistor, Carbon Film, 5.1 K ohm ±2%, ¼ W	R60-0002-075
R39	Resistor, Composition, 4.7 K ohm ±5%, ¼ W	R-1265
R40	Resistor, Metal Film, 90.9 ohm ±1%, ¼ W	10029-0632
R41	Resistor, Composition, 5.6 K ohm ±5%, ¼ W	R-1267
R42	Not Used	
R43	Not Used	
R44	Resistor, Composition, 3.9 K ohm ±5%, ¼ W	R-1263
R45	Resistor, Composition, 2 K ohm ±5%, ¼ W	R-1256
R46	Resistor, Composition, 130 ohm ±5%, ¼ W	R-1228
R47	Resistor, Carbon Film, 3.3 K ohm ±2%, ¼ W	R60-0002-070
R48	Resistor, Metal Film, 100 K ohm ±1%, ¼ W	10029-0631
R49	Resistor, Composition, 51 ohm ±5%, ¼ W	R-1218
R50	Resistor, Carbon Film, 10 K ohm ±2%, ¼ W	R60-0002-082
R51	Resistor, Carbon Film, 13 K ohm ±2%, ¼ W	R60-0002-085
R52	Resistor, Carbon Film, 13 K ohm ±2%, ¼ W	R60-0002-085
R53	Resistor, Carbon Film, 3 K ohm ±2%, ¼ W	R60-0002-069

TABLE 4

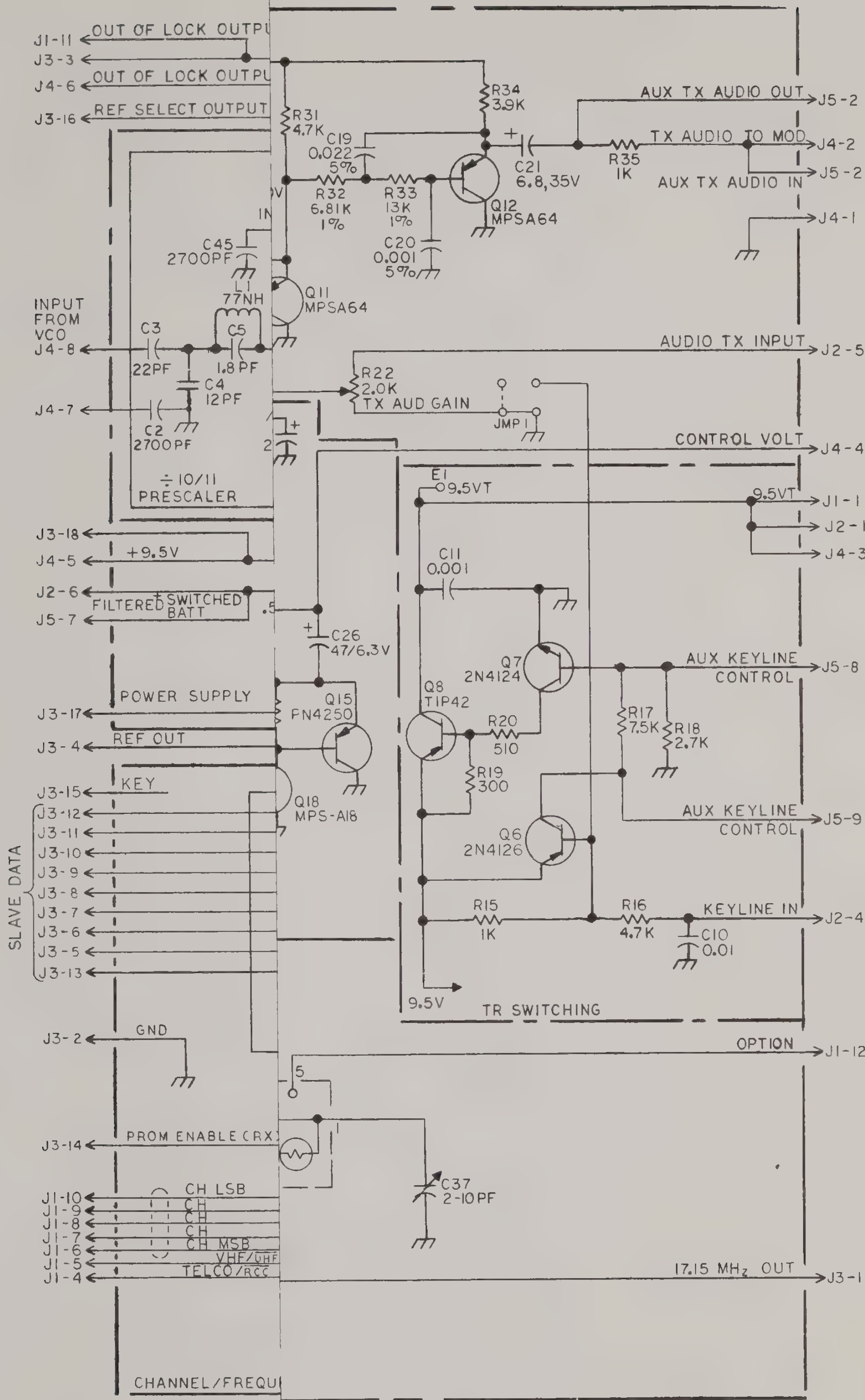
Master Synthesizer Logic Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
R54	Resistor, Carbon Film, 2 K ohm ±2%, ¼ W	R60-0002-065
R55	Not Used	
R56	Not Used	
R57	Resistor, Composition, 3.9 K ohm ±5%, ¼ W	R-1263
R58	Resistor, Composition, 180 ohm ±5%, ¼ W	R-1231
R59	Resistor, Composition, 220 ohm ±5%, ¼ W	R-1233
R60	Resistor, Composition, 43 ohm ±5%, ¼ W	R-1216
R61	Resistor, Composition, 3.9 K ohm ±5%, ¼ W	R-1263
R62	Resistor, Composition, 56 ohm ±5%, ¼ W	R-1219
RP1	Resistor Pack (9 x 10 K)	R50-0110-645
U1	Large Scale Integrated Circuit	6627-2725
U2	Integrated Circuit, SP8646/SP8647	I45-0002-000
U3	Integrated Circuit, PROM	
U4	Integrated Circuit, Voltage Regulator, NSC LM240LAZ5.0	IC-0291
Y1	Crystal Package, 4.5 PPM, used on 0900, and 0910	10029-0990
Y1	Crystal Package, 2 PPM, used on 0920, and 0930	10029-0441
Z1	Bead, Ferrite	L50-0002-000
	Heatsink	M07-0001-003
	Socket, I. C., 28-pin	J77-0005-028
	Socket, I. C., 20-pin	J77-0005-020
	Fuse Clip, PCB Mount	Z19-0009-000



NOTE:
- COMPONENTS SHOWN IN SOLID BLACK
- FACING SIDE FOIL SHOWN IN BLACK SCREEN
- OPPOSITE SIDE FOIL SHOWN IN RED SCREEN

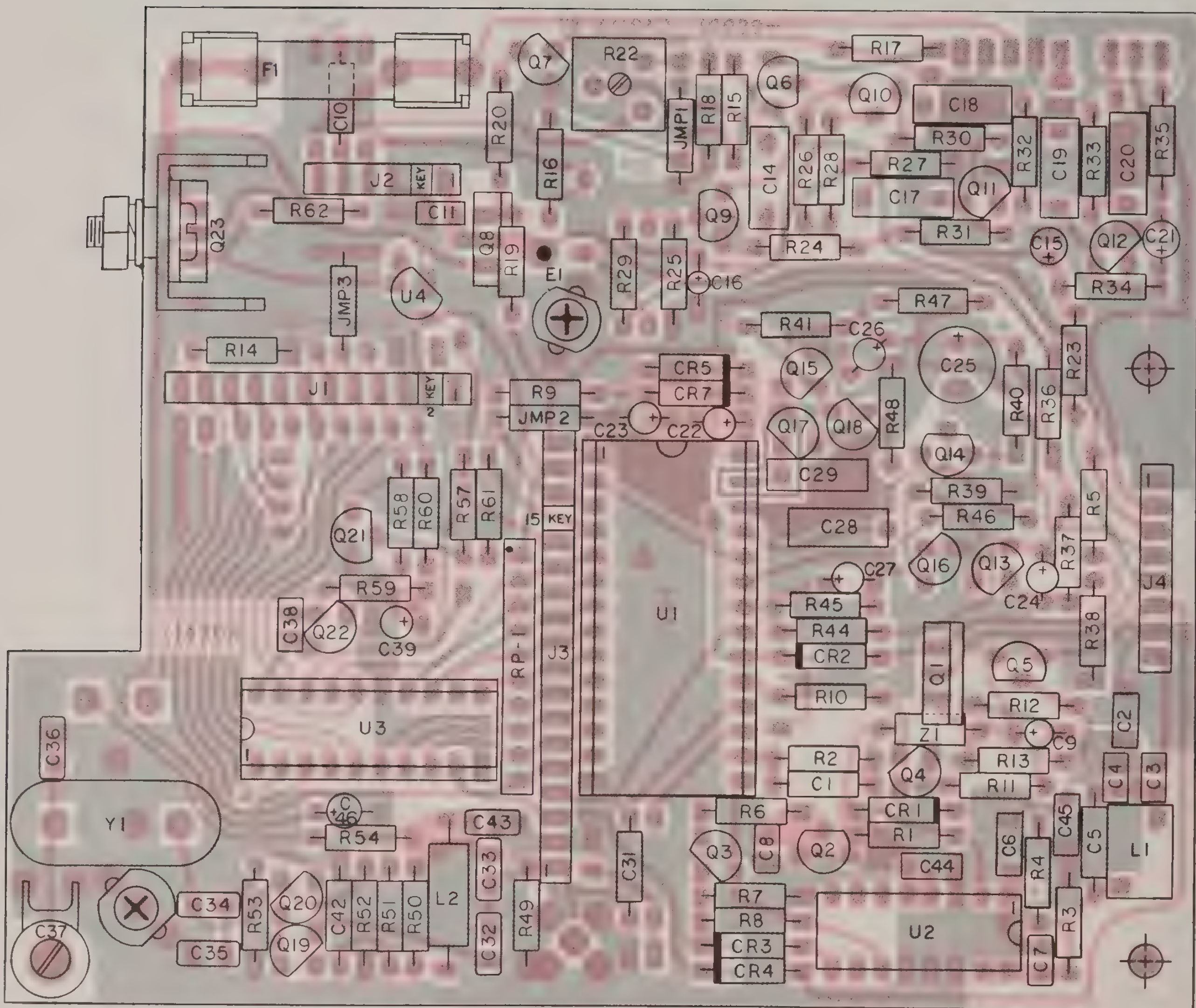
Figure 4. Master Synthesizer Logic Module, Component Location Diagram



NOTES: UNLESS OTHERWISE SPECIFIED

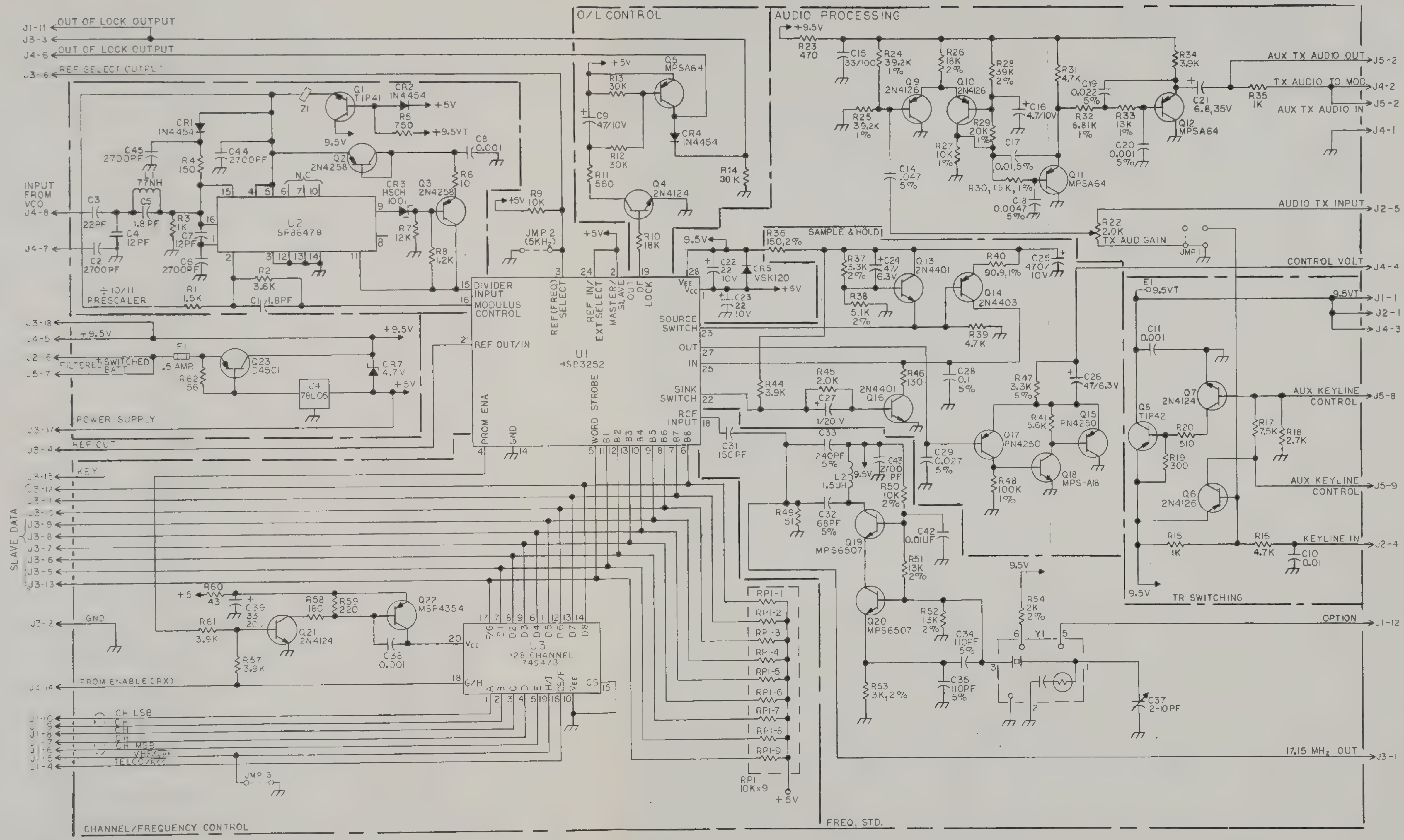
1. PARTIAL REFERENCE DESIGNATIO DESIGNATION PREFIX WITH UNIT DESIGNATION.
2. RESISTOR VALUES ARE IN OHMS,
3. CAPACITOR VALUES ARE IN UF.
4. VENDOR AND/OR JEDEC PART NUM ONLY; COMPONENTS ARE SUPPLIE

5. UHF/VHF Master Synthesizer Logic Module, Schematic Diagram



NOTE:
- COMPONENTS SHOWN IN SOLID BLACK
- FACING SIDE FOIL SHOWN IN BLACK SCREEN
- OPPOSITE SIDE FOIL SHOWN IN RED SCREEN

Figure 4. Master Synthesizer Logic Module, Component Location Diagram



NOTES: UNLESS OTHERWISE SPECIFIED:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER AND/OR ASSEMBLY DESIGNATION.
2. RESISTOR VALUES ARE IN OHMS, 1/4 W, 5%.
3. CAPACITOR VALUES ARE IN UF.
4. VENDOR AND/OR JEDEC PART NUMBER CALLOUTS ARE FOR REFERENCE ONLY; COMPONENTS ARE SUPPLIED PER PART NUMBER IN PARTS LIST.

COMP REF DESIG	0900	0910
JMP 2	OUT	IN
JMP 3	IN	OUT

HIGHEST REFERENCE DESIGNATION					
C45	R64	U3	Z1	CR5	Q23
RP1	Y1				
REFERENCE DESIGNATIONS NOT USED					
C12	C13	C20	C40	C41	
R14	R2.	R42	R55	R56	

Figure 5. UHF/VHF Master Synthesizer Logic Module, Schematic Diagram

TABLE 5

Slave Synthesizer Logic Module, Parts List

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
A6	SLV SYNTH LGC MOD	10029-0600
C1	Capacitor, Ceramic, axial 1.8 pF	C12-0001-004
C2	Capacitor, Ceramic, 2700 pF	C11-0016-272
C3	Capacitor, Ceramic, 22 pF	C11-0015-220
C4	Capacitor, Ceramic, 12 pF	C11-0015-120
C5	Capacitor, Ceramic, axial 1.8 pF	C12-0001-004
C6	Capacitor, Ceramic, 2700 pF	C11-0016-272
C7	Capacitor, Ceramic, 12 pF	C11-0015-120
C8	Capacitor, Ceramic, 1000 pF	C11-0016-102
C9	Capacitor, Ceramic, 2700 pF	C11-0016-272
C10	Capacitor, Tantalum, 4.7 μF, 20V	C-6446
C11	Capacitor, Tantalum, 22 μF, 20V	C-6450
C12	Capacitor, Tantalum, 22 μF, 20V	C-6450
C13	Capacitor, Tantalum, 47 μF, 6V	C25-0010-607
C14	Capacitor, Electrolytic, 470 μF	C19-0002-471
C15	Capacitor, Tantalum, 47 μF, 6V	C25-0010-607
C16	Capacitor, Tantalum, 1 μF, 35V	C-6421
C17	Capacitor, Polypro, 0.1 μF	C60-0005-104
C18	Capacitor, Mylar, 0.027 μF	10029-0952
C19	Not Used	
C20	Capacitor, Ceramic, axial 150 pF	C12-0001-039
C21	Capacitor, Ceramic, 2700 pF	C11-0016-272
CR1	Diode, Switching, 1N6263	D10-6263-000
CR2	Diode, Signal, 1N4454	CR-0705

TABLE 5

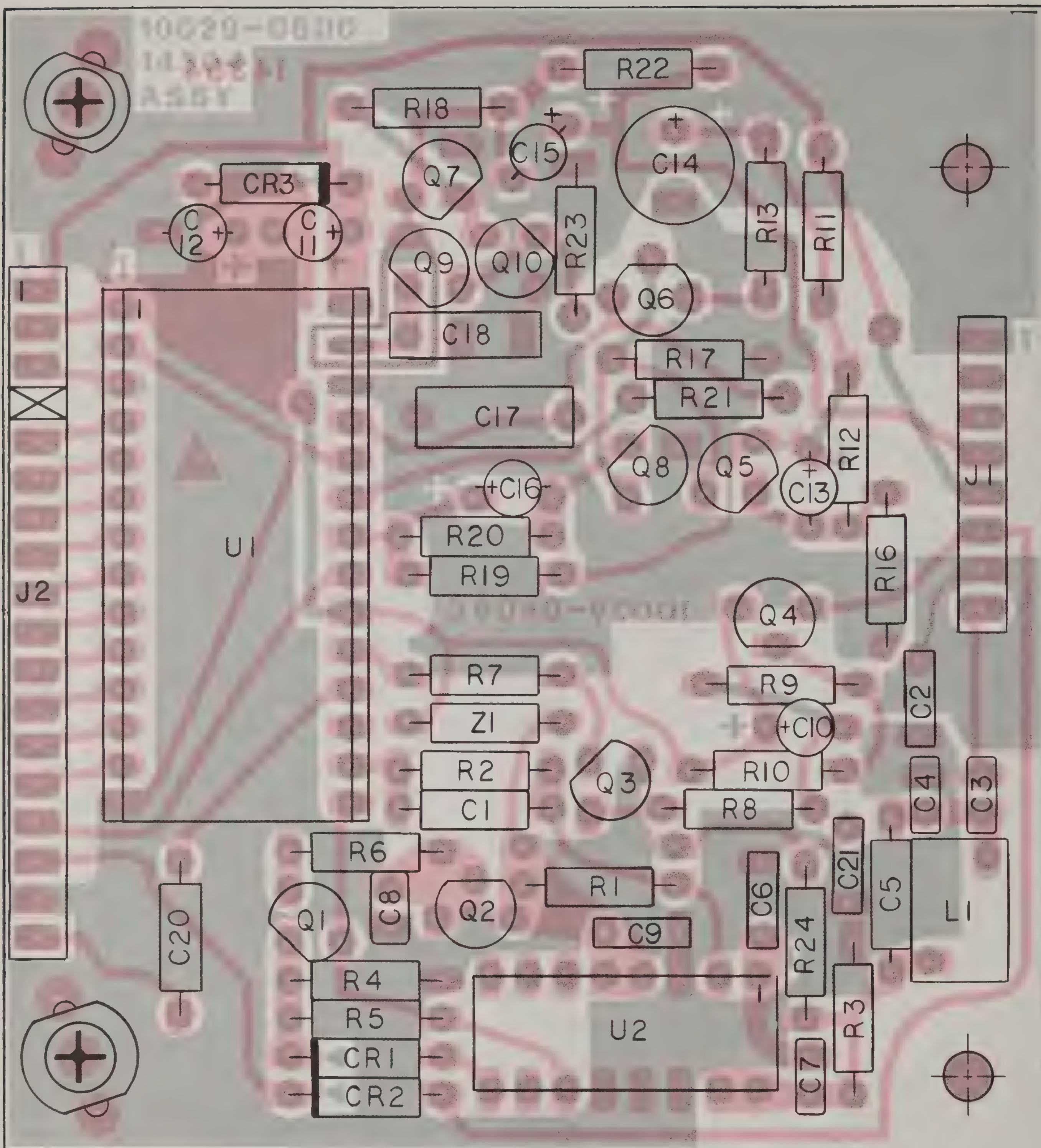
Slave Synthesizer Logic Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
CR3	Diode	10029-0635
J1	Connector, 8-pin	J41-0009-008
J2	Connector, male, 18-pin	J41-0002-018
L1	Choke, Molded, 0.077 μH	LO5-0001-007
Q1	Transistor, PN4258	Q-0153
Q2	Transistor, PN4258	Q-0153
Q3	Transistor, 2N4124	Q-0385
Q4	Transistor, 2N4126	Q-0386
Q5	Transistor, 2N4401	Q02-4401-000
Q6	Transistor, 2N4403	Q02-4403-000
Q7	Transistor, PN4250	Q22-0001-000
Q8	Transistor, 2N4401	Q02-4401-000
Q9	Transistor, PN4250	Q22-0001-000
Q10	Transistor, MPS-A18	Q25-0005-000
R1	Resistor, Composition, 1.5 K ohm ±5%, ¼ W	R-1253
R2	Resistor, Composition, 3.6 K ohm ±5%, ¼ W	R-1262
R3	Resistor, Composition, 68 K ohm ±5%, ¼ W	R-1293
R4	Resistor, Composition, 12 K ohm ±5%, ¼ W	R-1275
R5	Resistor, Composition, 1.2 K ohm ±5%, ¼ W	R-1251
R6	Resistor, Composition, 10 ohm ±5%, ¼ W	R-1201
R7	Resistor, Composition, 18 K ohm ±5%, ¼ W	R-1279
R8	Resistor, Composition, 10 K ohm ±5%, ¼ W	R-1273
R9	Resistor, Composition, 5.6 K ohm ±5%, ¼ W	R-1267
R10	Resistor, Composition, 10 K ohm ±5%, ¼ W	R-1273

TABLE 5

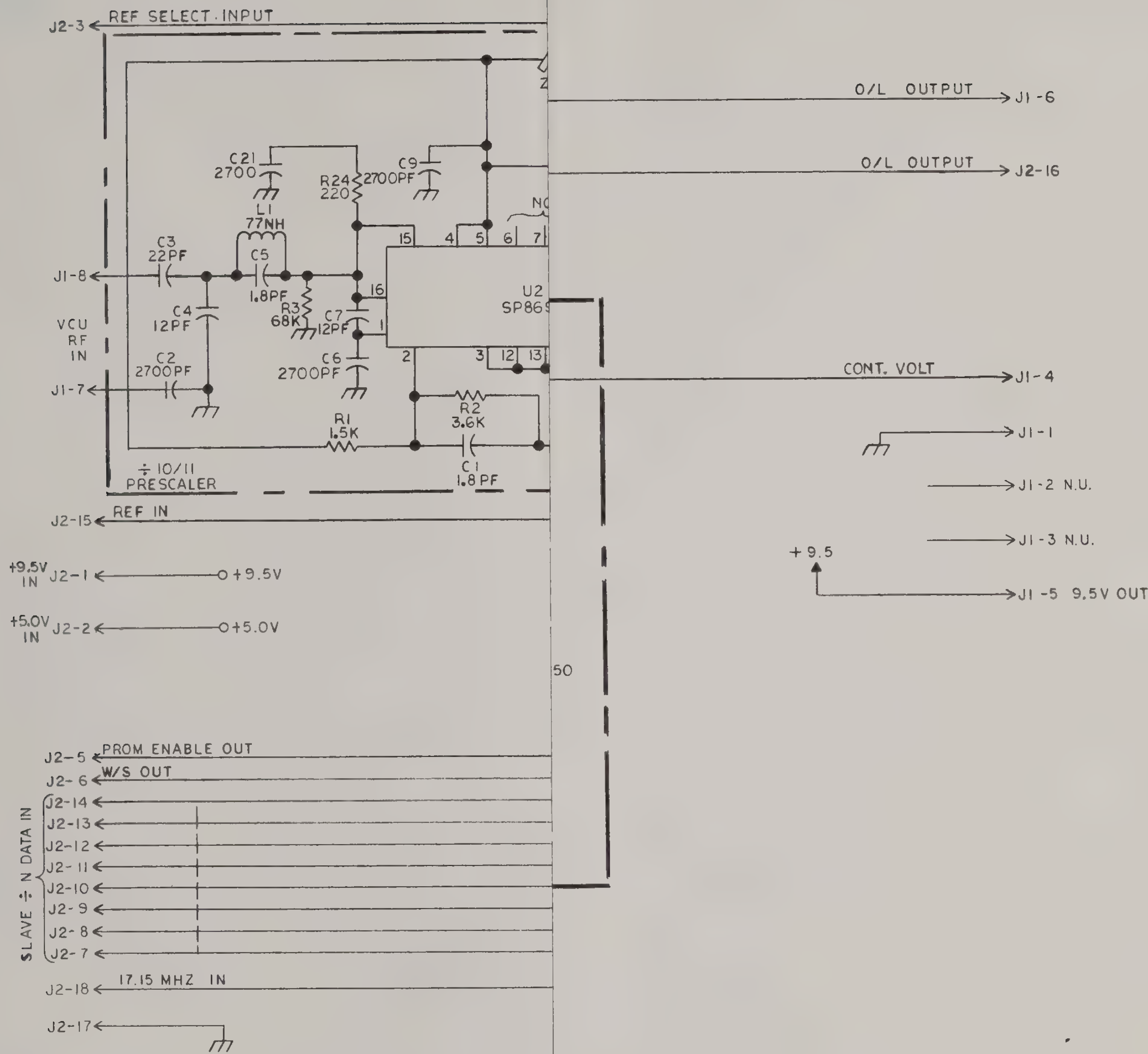
Slave Synthesizer Logic Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
R11	Resistor, Carbon Film, 150 ohm ±2%, ¼ W	R60-0002-037
R12	Resistor, Carbon Film, 3.3 K ohm ±2%, ¼ W	R60-0002-070
R13	Resistor, Fixed, 90.9 ohm ±1%, ¼ W	10029-0632
R14	Not Used	
R15	Not Used	
R16	Resistor, Carbon Film, 5.1 K ohm ±2%, ¼ W	R60-0002-075
R17	Resistor, Composition, 4.7 K ohm ±5%, ¼ W	R-1265
R18	Resistor, Composition, 5.6 K ohm ±5%, ¼ W	R-1267
R19	Resistor, Composition, 3.9 K ohm ±5%, ¼ W	R-1263
R20	Resistor, Composition, 2 K ohm ±5%, ¼ W	R-1256
R21	Resistor, Composition, 130 ohm ±5%, ¼ W	R-1228
R22	Resistor, Carbon Film, 3.3 K ohm ±2%, ¼ W	R60-0002-070
R23	Resistor, Fixed, 100 K ohm ±1%, ¼ W	10029-0631
R24	Resistor, Composition, 220 ohm ±5%, ¼ W	R-1233
U1	Large Scale Integrated Circuit	6627-2725
U2	Integrated Circuit, SP8690B	145-0001-000
Z1	Ferrite Bead	L50-0002-000
	Socket, I. C., 28-pin	J77-0005-028



NOTE:
- COMPONENTS SHOWN IN SOLID BLACK
- FACING SIDE FOIL SHOWN IN BLACK SCREEN
- OPPOSITE SIDE FOIL SHOWN IN RED SCREEN

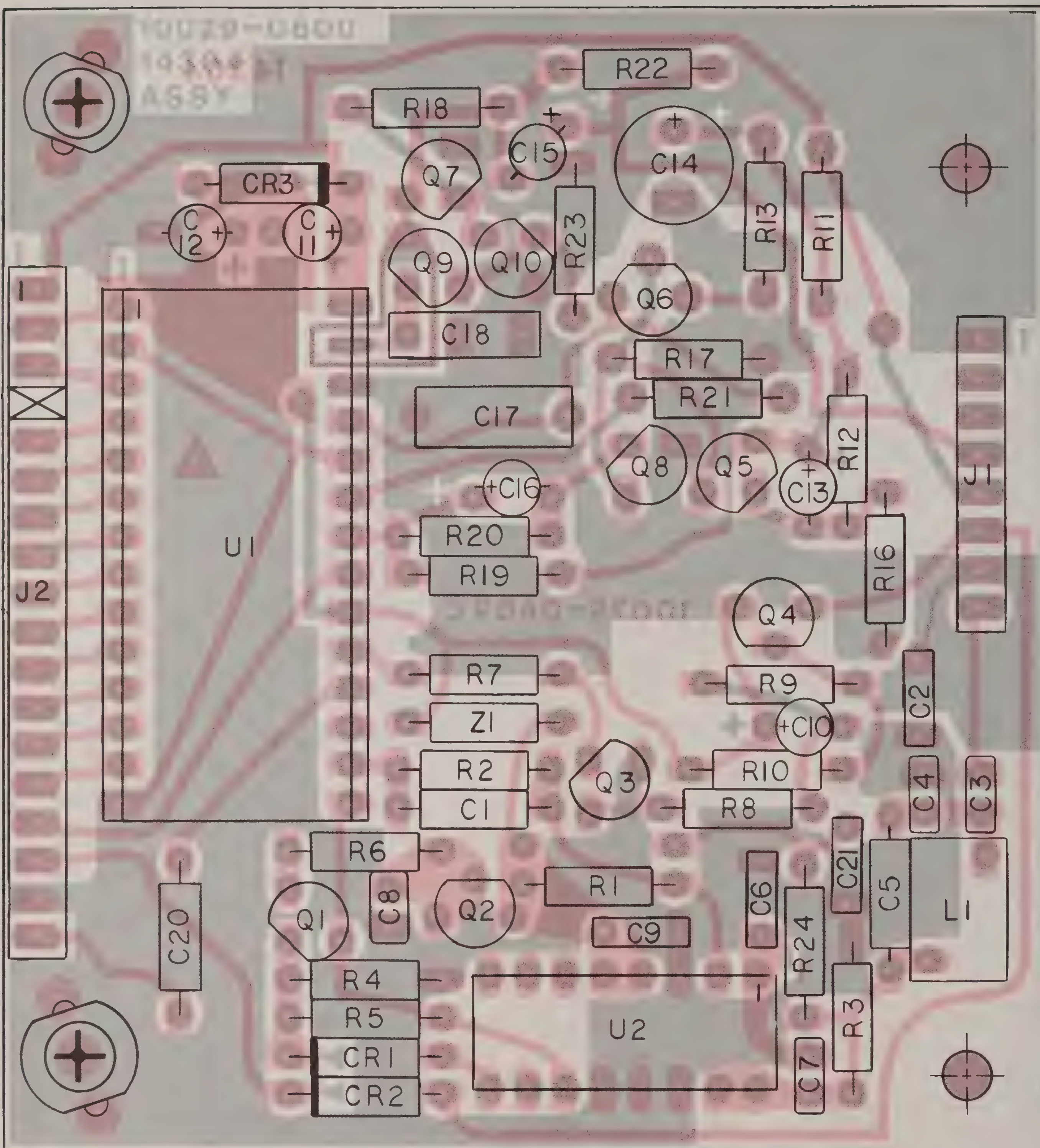
Figure 6. UHF/VHF Slave Synthesizer Logic Module, Component Location Diagram



NOTES: UNLESS OTHERWISE SPECIFIED:

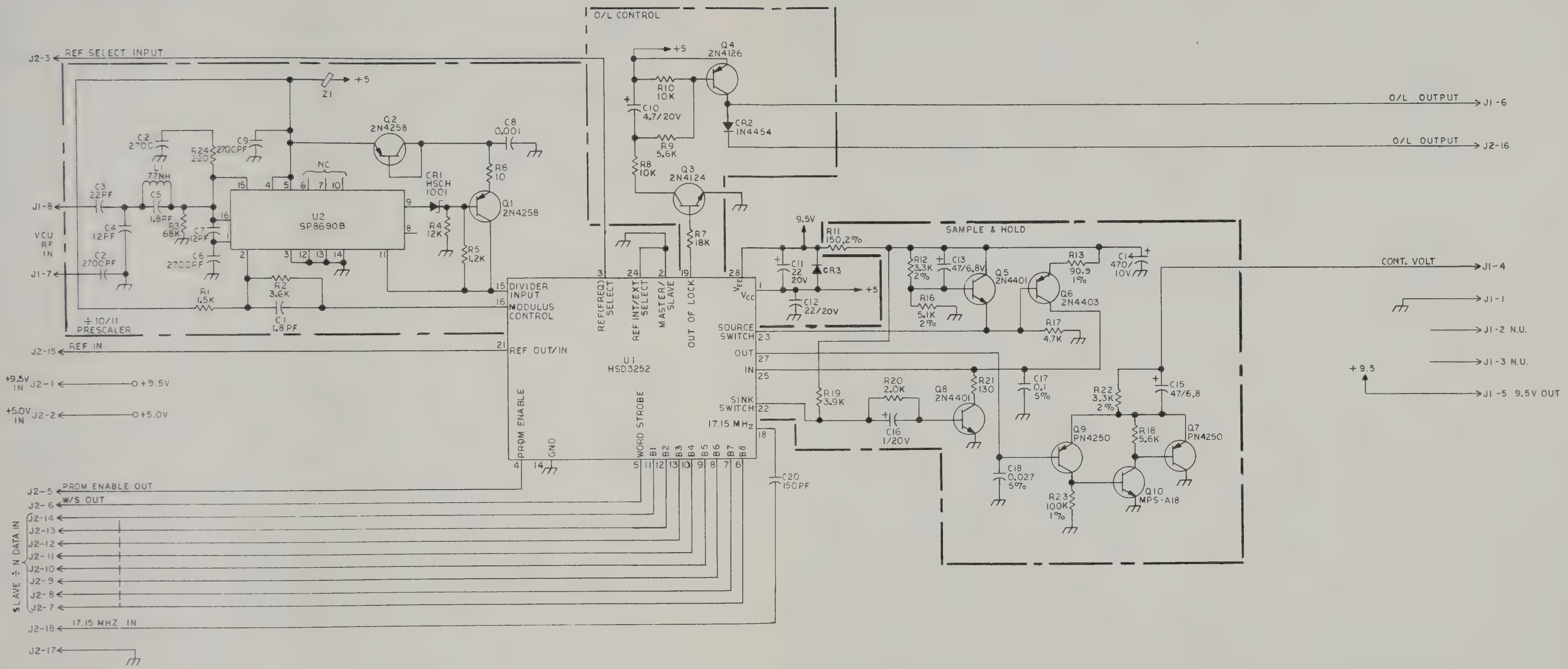
1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER AND/OR ASSEMBLY DESIGNATION.
2. RESISTOR VALUES ARE IN OHMS, 1/4W, 5%.
3. CAPACITOR VALUES ARE IN UF.
4. VENDOR AND/OR JEDEC PART NUMBER CALLOUTS ARE FOR REFERENCE ONLY: COMPONENTS ARE SUPPLIED PER PART NUMBER IN PARTS LIST.

ıre 7. UHF/VHF Slave Synthesizer Logic Module, Schematic Diagram



NOTE:
- COMPONENTS SHOWN IN SOLID BLACK
- FACING SIDE FOIL SHOWN IN BLACK SCREEN
- OPPOSITE SIDE FOIL SHOWN IN RED SCREEN

Figure 6. UHF/VHF Slave Synthesizer Logic Module, Component Location Diagram



NOTES: UNLESS OTHERWISE SPECIFIED:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER AND/OR ASSEMBLY DESIGNATION.
2. RESISTOR VALUES ARE IN OHMS, 1/4W, 5%.
3. CAPACITOR VALUES ARE IN UF.
4. VENDOR AND/OR JEDEC PART NUMBER CALLOUTS ARE FOR REFERENCE ONLY: COMPONENTS ARE SUPPLIED PER PART NUMBER IN PARTS LIST.

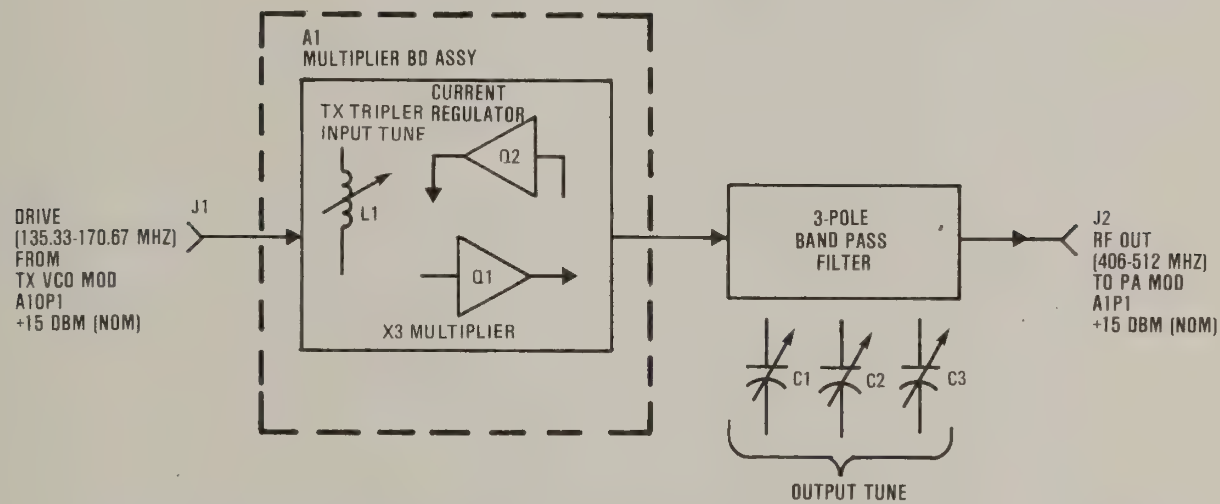
HIGHEST REFERENCE DESIGNATION					
J1	P1	L1	U2	Q10	CR3
R24	C21	Z1			
REFERENCE DESIGNATIONS NOT USED					
R5	R9	R14	R15	C19	

Figure 7. UHF/VHF Slave Synthesizer Logic Module, Schematic Diagram

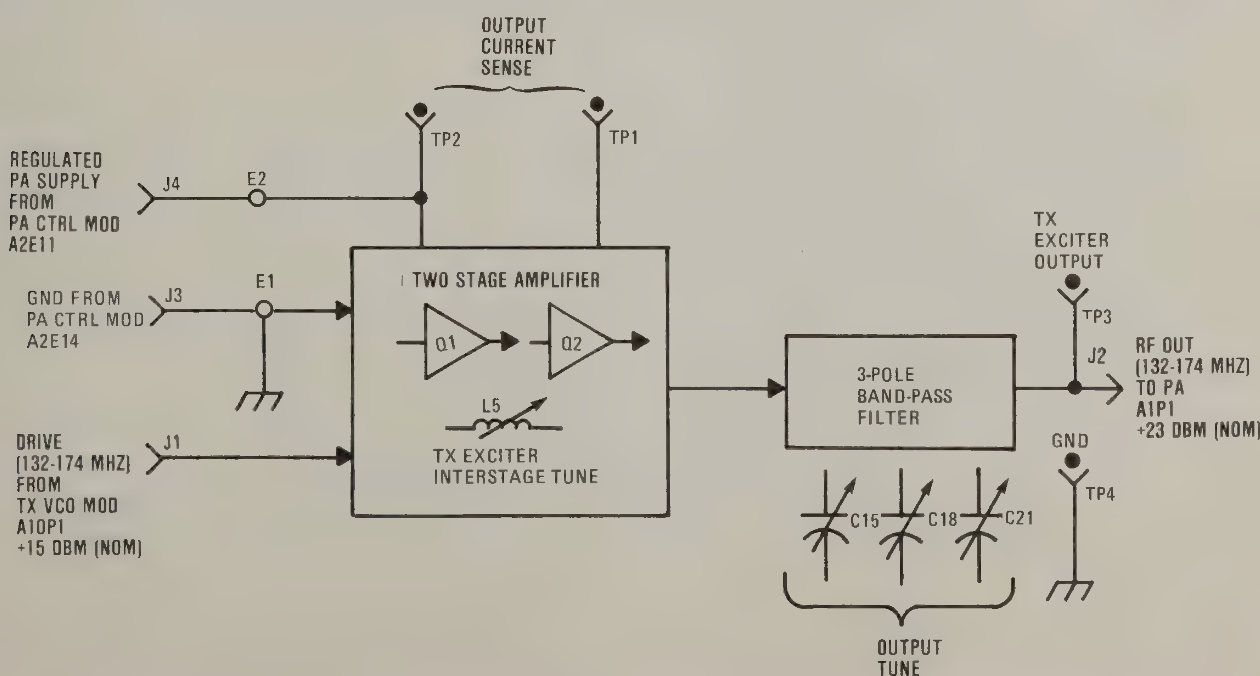
A7

TX EXCTR MOD

UHF (406–512 MHz): 10029-1700
VHF (150.8–174 MHz): 10029-2700
VHF (132–150.8 MHz): 10029-2710



UHF



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LIST OF TABLES

1. GENERAL

1.01 Simplified block diagrams of the UHF and VHF Tx Exciter Modules are presented on the cover of this tab section.

1.02 The UHF Exciter Module consists of a single stage frequency tripler, with a current sensing feedback loop which stabilizes the operating point, and a three-pole comb-line output filter. Power gain is approximately unity, with a nominal output level of +15 dBm. Output tuning range is 406 to 512 MHz.

1.03 The VHF Exciter Module consists of a two-stage amplifier, followed by a three-pole L-C filter. Power gain is approximately 8dB, with a nominal output level of +23 dBm. A module covering the 132 to 150.8 MHz range and a module covering the 150.8 to 174 MHz range are available.

2. INTERFACE CONNECTIONS

2.01 Interface connections for the Tx Exciter Modules (UHF and VHF) are listed in tables 1A and 1B, respectively.

TABLE 1A

UHF Tx Exciter Module Interface Connections

REF DESIG	FUNCTION	TO	FROM
J1	Drive In	—	A10P1
J2	RF Out	A1P1	—

TABLE 1B

VHF Tx Exciter Module Interface Connections

REF DESIG	FUNCTION	TO	FROM
J1	Drive In	—	A10P1
J2	RF Out	A1P1	—
J3	Gnd	—	A2E14
J4	Reg +12.5V	—	A2E11

3. SUPPLEMENTARY SEMICONDUCTOR DATA

3.01 Transistor lead identification diagrams will be found on pages 4-13 and 4-14 of the maintenance chapter in this manual.

4. TECHNICAL DESCRIPTION

A UHF Tx Exciter Module Description

4.01 Details of the UHF Tx Exciter Module circuit appear in figure 4. The majority of the components are located on Multiplier Board Assembly A1. This board, and the remaining components are mounted inside the cover of the Tx Exciter Module. The base of the module provides shielding, and also regulates coupling between filter elements through selection of aperture sizes.

4.02 The drive signal (at a nominal +15 dBm level) arrives at J1 superimposed upon a +9.5 dc voltage. The latter supplies dc power for operation of the module. It is separated from the drive signal by A1L2 and A1C7; and blocked from the A1Q1 base circuit by A1C4. The drive signal is applied to the base of A1Q1 through matching circuit A1L1, A1C1, and A1C2 which is tuned to the drive frequency.

4.03 A1Q2 operates with zero forward bias, being driven on only by the input signal. Therefore, it operates in a nonlinear fashion, with an output high in harmonics. The three-pole bandpass filter L1-L3, C1-C3 passes only the third harmonic of the drive frequency. This filter is of an improved comb-line type designed to realize maximum stop band attenuation. The desired third harmonic appears at J2, at a nominal level of +15 dBm.

4.04 In order to stabilize the operating point, the collector current of A1Q1 is monitored by observing the voltage drop across A1R4. This drop acts to turn on A1Q2, drawing current through pin diode shunt attenuator A1CR1. The drive signal to A1Q1, and thus its collector current is reduced by this action. The loop is self-stabilizing with resultant typical collector current of 35 to 40 ma.

4.05 The UHF Tx Exciter Module can be adjusted to any output frequency within the range of 406 to 512 MHz, without making component value changes.

B. VHF Tx Exciter Module Description

4.06 Details of the VHF Tx Exciter Module circuit appear in figure 6. A drive signal from Tx VCO Module A10 enters at J1, at a nominal level of +15 dBm. Broadband matching is provided at the base of Q1. Q1 and Q2 are amplifiers, coupled by an interstage circuit tuned by adjustment of L5. The output of Q2 is applied to a three-pole tunable bandpass filter, followed by a 3 DB pad. The latter provides interface impedance stabilization, as the rf output signal passes through J2 to PA Module A1. The collector current of Q2 may be monitored during alignment by connecting a dc voltmeter between TP1 and TP2

4.07 Two VHF Tx Exciter Modules, differing only in a few component values, permit coverage of a frequency range of 132 to 174 MHz, as follows:

P/N 10029-2710	132 to 150.8 MHz
P/N 10029-2700	150.8 to 174 MHz

5. MAINTENANCE

A. General Information

5.01 The adjustments indicated by the alignment procedures described in this section are made at the factory prior to shipment. Normally, it should not be necessary to repeat any of these adjustments unless there are component failures or a change in operating frequency range is being made.

5.02 Because of the high drive level (+15 dBm) and the need for supplying +9.5 Vdc on the input line for the UHF Tx Exciter, it is important that the Exciter Module be aligned as part of the complete Transceiver. The following alignment procedures assume that a Control Unit and an adequate power supply are connected, and that the synthesizer tune-up procedure as described in tab section A6/A9 has been completed.

B. UHF Tx Exciter Module Alignment Procedure

5.03 Refer to figure 1 for control locations.

(a) Select a midchannel in frequency range to be covered at the Control Unit.

(b) Remove Tx control line at E3 on PA Control Module A2.

(c) Disconnect PA input plug A1P1 from Exciter output jack J2.

(d) Connect rf voltmeter with 50-ohm probe to Tx Exciter output jack J2.

(e) Key Transceiver and adjust Tx tripler output tune capacitors C1, C2, and C3, and Tx tripler input tune A1L1 for maximum indication on rf voltmeter.

(f) Repeat adjustment until no further improvement is possible. Normal output is slightly over one volt. Unkey Transceiver.

(g) Reconnect PA input plug A1P1 to Tx Exciter output jack J2.

(h) Reconnect Tx control line at E3 on PA Control Module.

C. VHF Tx Exciter Module Alignment Procedure

5.04 Refer to figure 1 for control locations.

(a) Select a midchannel in frequency range to be covered at Control Unit.

(b) Disconnect PA input plug A1P1 from Tx Exciter Module output jack J2.

(c) Connect a 50-ohm load, or if available, an rf voltmeter with 50-ohm probe to Tx Exciter Module output jack J2.

(d) Connect dc voltmeter between TP2(+) and TP1(−). Use one volt range.

(e) Key Transmitter. Adjust inductor L5 for maximum meter indication at TP1 and TP2. Adjust C15 for maximum meter indication and C18 for minimum meter indication. Then adjust C21 for maximum meter indication. (Ensure that this order is followed.)

(f) Unkey Transmitter. Use rf voltmeter for the rest of procedure. If unavailable, connect a dc voltmeter between TP3(+) and TP4(−). Select range which provides full meter deflection.

(g) Key Transmitter. Adjust trimmers C21, C18, C15 and inductor L5 for maximum meter indication at Exciter Module output.

(h) Readjust trimmer C18 for minimum meter indication. Increase the meter sensitivity for this measurement.

(i) Readjust trimmer C21 and C15 for maximum meter indication. Use extreme care in performing this step for the new maxima are close in level and position to the maxima determined prior to this step.

(j) Readjust trimmer C18 for maximum meter indication. A voltage indication of approximately 3V (rf or dc) indicates a correct nominal output of 180 mW.

(k) Unkey Transmitter. Disconnect test equipment. Reconnect PA Drive (RF Out) at Tx Exciter output jack J2.

6. PARTS LIST

A . UHF Tx Exciter Module

6.01 Table 2 lists and identifies all of the electronic parts on the UHF Tx Exciter Cover Assembly. Figure 2 gives component location information for the UHF Tx Exciter cover assembly. Table 3 lists and identifies Multiplier Board Assembly A1 parts. Figure 3 gives component location information for UHF Tx Multiplier Board Assembly A1.

B . VHF Tx Exciter Module

6.02 Table 4 lists and identifies all of the electronic parts on the VHF Tx Exciter Module, while figure 5 gives the component location information for the VHF Tx Exciter Module.

7. SCHEMATIC DIAGRAMS

A. UHF Tx Exciter Module

7.01 Figure 4 is the schematic diagram for the UHF Tx Exciter Module.

B. VHF Tx Exciter Module

7.02 Figure 6 is the schematic diagram for the VHF Tx Exciter Module.

Figure 1. Tx Exciter Module, Adjustments

TABLE 2

UHF Tx Exciter Module, Cover Assembly Parts List

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
A7	TX EXCTR MOD	10029-1700
	Cover Assembly	10029-1710
A1	Multiplier Board Assembly	10029-1720
	(See Table 3)	
C1	Capacitor, Variable, 1-10 pF	C-2178
C2	Capacitor, Variable, 1-10 pF	C-2178
C3	Capacitor, Variable, 1-10 pF	C-2178
J1	Jack, Coax	J-0086
J2	Jack, Coax	J-0086
L1	Tuning Rod	10029-1417
L2	Tuning Rod	10029-1417
L3	Tuning Rod	10029-1417

TABLE 3

UHF Tx, Multiplier Board Assembly A1, Parts List

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
A7A1	MLTPR BD ASSY	10029-1720
C1	Capacitor, UNELCO, 10 pF	C45-0001-100
C2	Capacitor, Ceramic, 27 pF	C-6819
C3	Capacitor, Ceramic, 100 pF	C-6830
C4	Capacitor, Ceramic, 100 pF	C-6830
C5	Capacitor, UNELCO, 47 pF	C45-0001-470
C6	Capacitor, Ceramic, 0.1 μF, 50V	C11-0005-104
C7	Capacitor, Ceramic, 0.1 μF, 50V	C11-0005-104
CR1	Diode, PIN	919-1261
CR2	Diode, Signal, 1N4454	CR-0705
L1	Inductor Variable	10029-1730
L2	Coil, rf, molded, 3.3 μH	L-0622
L3	Coil, rf, molded, 0.47 μH	L-0612
Q1	Transistor, BFR96	10029-0991
Q2	Transistor, 2N4126	Q-0386
R1	Resistor, Composition, 1000 $\pm$5%, ⅛W	RCR05G102JM
R2	Resistor, Composition, 3300 $\pm$5%, ⅛W	RCR05G332JM
R3	Resistor, Composition, 1500 $\pm$5%, ⅛W	RCR05G152JM
R4	Resistor, Composition, 15 ohm $\pm$5%, ¼W	RCR07G150JM
R5	Resistor, Composition, 22 ohm $\pm$5%, ⅛W	RCR05G220JM

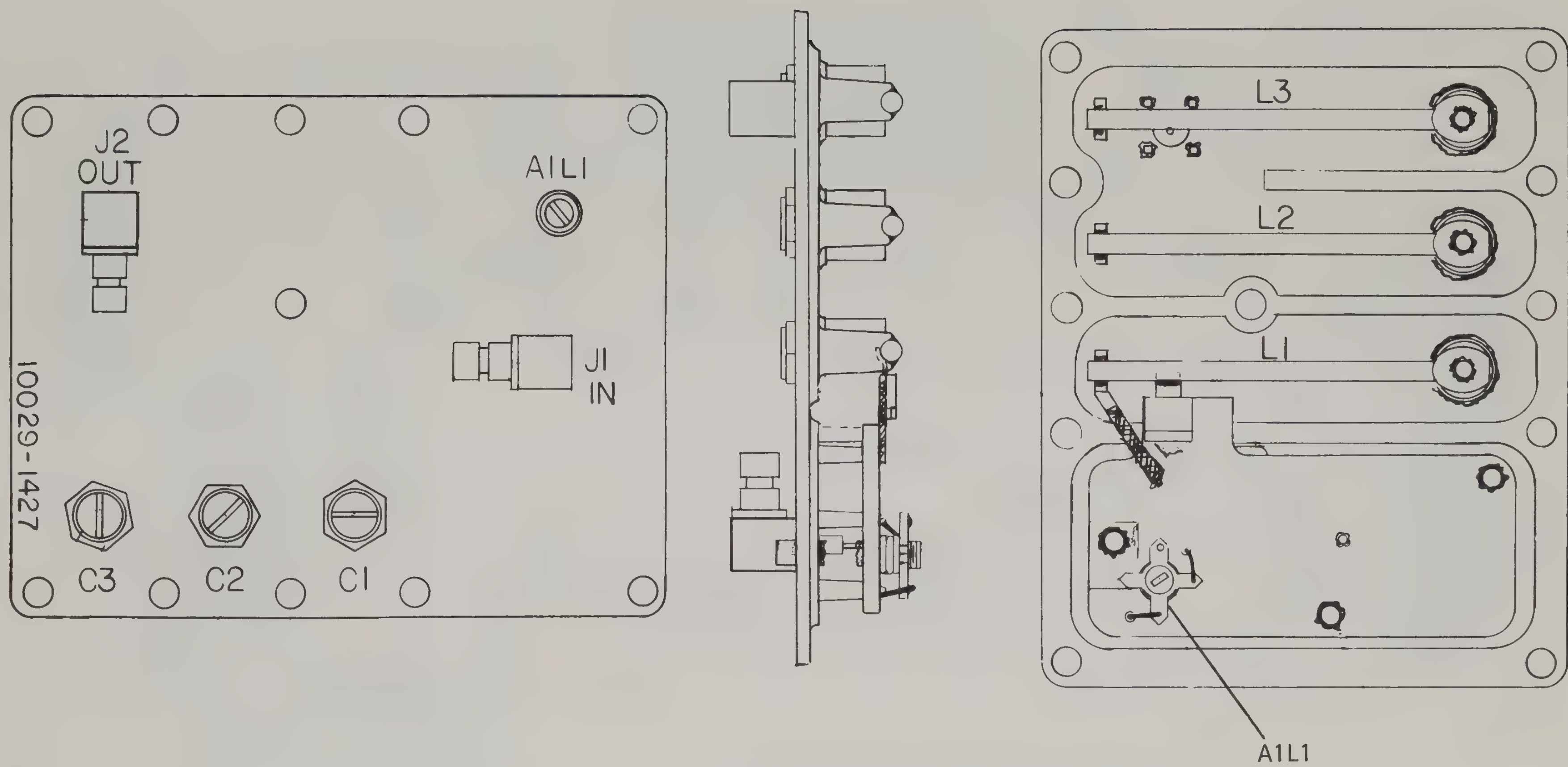


Figure 2. UHF Tx Exciter Cover Assembly, Component Location Diagram

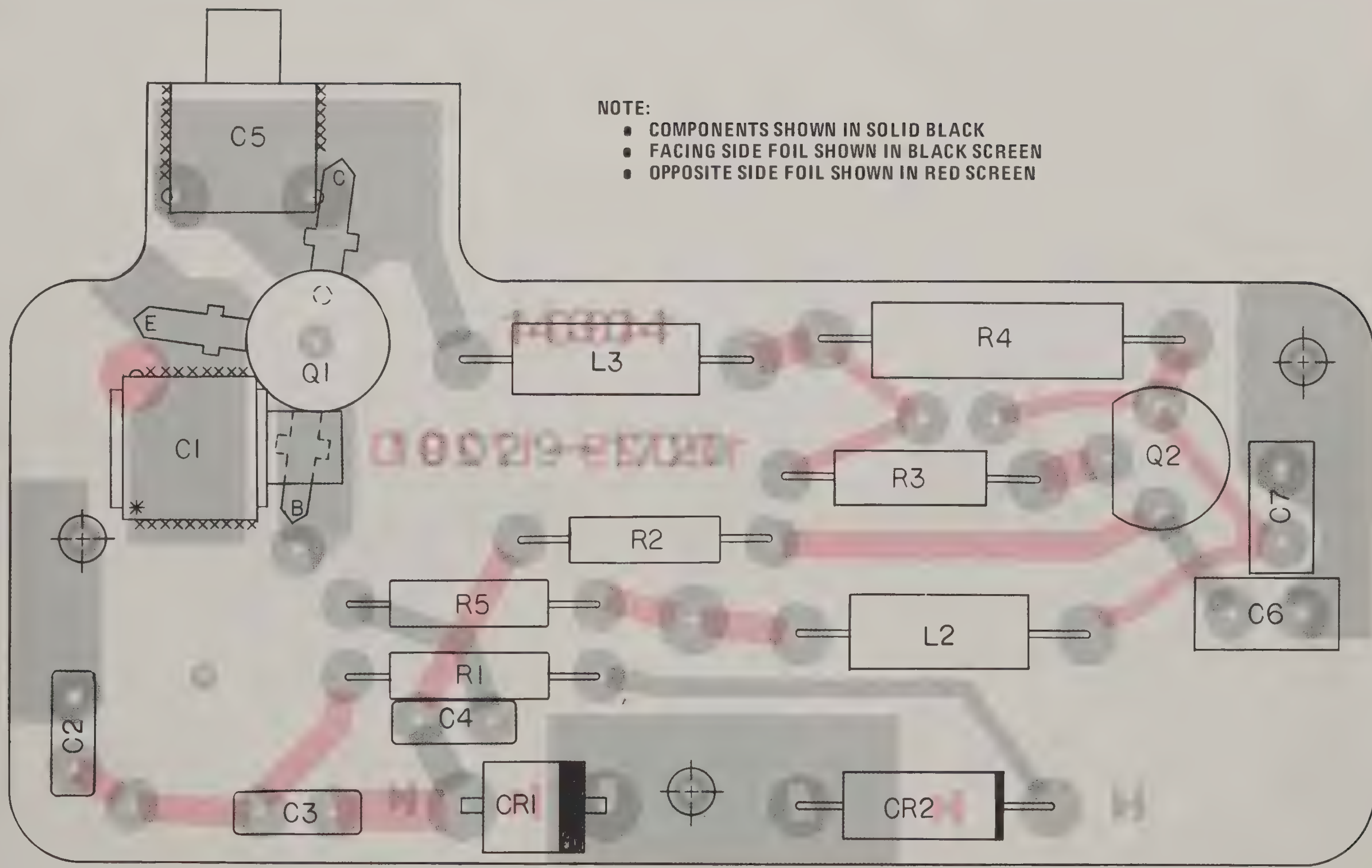
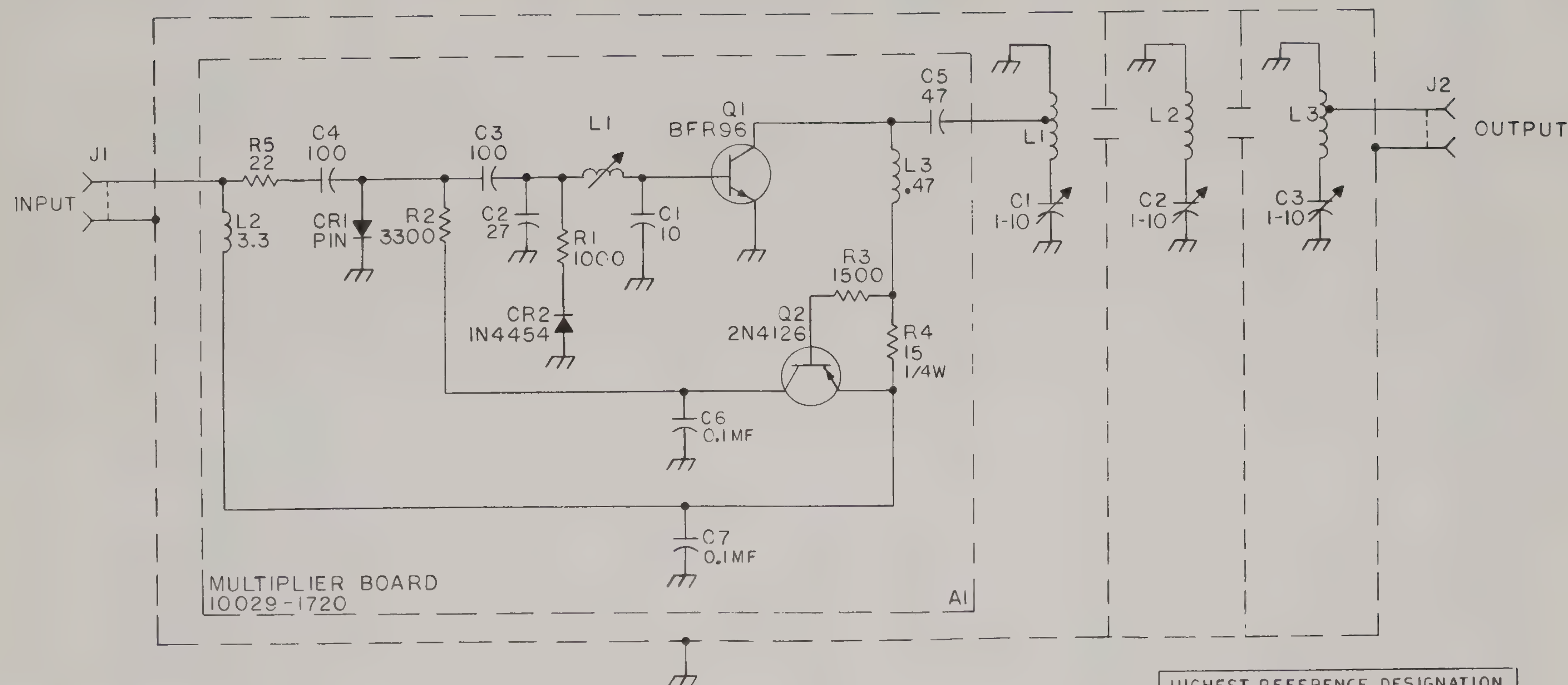


Figure 3. UHF Tx Multiplier Board Assembly A1, Component Location Diagram



NOTES: UNLESS OTHERWISE SPECIFIED:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER AND/OR ASSEMBLY DESIGNATIONS.
2. RESISTOR VALUES ARE IN OHMS.
3. CAPACITOR VALUES ARE IN PF.
4. VENDOR AND/OR JEDEC PART NUMBER CALLOUTS ARE FOR REFERENCE ONLY; COMPONENTS ARE SUPPLIED PER PART NUMBER IN PARTS LIST.
5. INDUCTANCE VALUES ARE IN MICROHENRIES.

HIGHEST REFERENCE DESIGNATION						
C3	J2	L3	A1C7	A1L3	A1CR2	A1Q2
A1R5						

Figure 4. UHF Tx Exciter Module, Schematic Diagram

TABLE 4

VHF Tx Exciter Module, Parts List

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
A7	VHF TX EXCTR MOD	10029-2700
C1	Capacitor, Ceramic, 25 pF, 1000V	C-4747
C2	Capacitor, Mica, 56 pF	C45-0001-560
C3	Capacitor, Mica, 56 pF	C45-0001-560
C4	Capacitor, Ceramic, 0.1 μF, 50V	C-3202
C5	Capacitor, Ceramic, axial, .01 μF	C12-0001-056
C6	Capacitor, Tantalum, 15 μF, 20V	C-3103
C7	Not Used	
C8	Capacitor, Ceramic, axial, 150 pF	C12-0001-039
C9	Capacitor, Ceramic, axial, 150 pF	C12-0001-039
C10	Not Used	
C11	Capacitor, Ceramic, axial, 2.7 pF	C12-0001-006
C12	Capacitor, Ceramic, axial, 3.3 pF	C12-0001-007
C13	Capacitor, Ceramic, axial, 470 pF	C12-0001-045
C14	Capacitor, Ceramic, axial, 3.3 pF	C12-0001-007
C15	Capacitor, Trimmer, 1.9–15.7 pF	C-1186
C16	Capacitor, Ceramic, axial, 5.6 pF	C12-0001-010
C17	Capacitor, Tubular, 0.33 pF, 500V	C-4596
C18	Capacitor, Trimmer, 1.9–15.7 pF	C-1186
C19	Capacitor, Ceramic, axial, 10 pF	C12-0001-013
C20	Capacitor, Tubular, 0.43 pF, 500V	C-4599
C21	Capacitor, Trimmer, 1.9–15.7 pF	C-1186
C22	Capacitor, Ceramic, axial, 8.2 pF	C12-0001-012
C23	Capacitor, Ceramic, axial, 2.2 pF	C12-0001-005

TABLE 4

VHF Tx Exciter Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
C24	Capacitor, Ceramic, axial, 150 pF	C12-0001-039
CR1	Diode, Epoxy, 1N4004	CR-0725
CR2	Diode, Epoxy, 1N4004	CR-0725
CR3	Diode, Signal, 1N277	CR-0065
J1	Connector, Coax, Snap-on	J-0031
J2	Connector, Coax, Snap-on	J-0031
J3	Pin Receptacle	MP-0286
J4	Pin Receptacle	MP-0286
L1	Choke, molded, 0.022 μH	LO5-0001-002
L2	Choke, molded, 0.018 μH	LO5-0001-001
L3	Choke, molded, 0.137 μH	LO5-0001-011
L4	Choke, molded, 0.077 μH	LO5-0001-007
L5	Inductor, Variable	10029-2730
L6	Choke, molded, 0.065 μH	LO5-0001-006
L7	Choke, rf, 4.7 μH	L-0056
L8	Coil, 1½ Turns	6611-0318
L9	Coil, 1½ Turns	6611-0318
L10	Coil, 1½ Turns	6611-0318
Q1	Transistor, 2N4427	Q-0343
Q2	Transistor, 2N3924	Q-0345
R1	Resistor, Composition, 220 ohm ±5%, 1W	R-1633
R2	Resistor, Composition, 1 ohm ±5%, ½W	R-1567
R3	Resistor, Composition, 3.3 ohm ±5%, ¼W	R-1356
R4	Resistor, Composition, 10 ohm ±5%, ¼W	R-1201

TABLE 4

VHF Tx Exciter Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
R5	Resistor, Composition, 470 ohm ±5%, 1/4 W	R-1241
R6	Resistor, Composition, 5.6 ohm ±5%, 1/4 W	R-1362
R7	Resistor, Composition, 5.6 ohm ±5%, 1/4 W	R-1362
R8	Resistor, Composition, 220 ohm ±5%, 1/4 W	R-1233
R9	Resistor, Composition, 10K ohm ±5%, 1/4 W	R-1273
R10	Resistor, Composition, 100 ohm ±5%, 1/4 W	R-1225
R11	Resistor, Composition, 3K ohm ±5%, 1/4 W	R-1260
R12	Resistor, Composition, 5.6 ohm ±5%, 1/4 W	R-1362
TP1	Tip Jack, Red	J-0066
TP2	Tip Jack, Red	J-0066
TP3	Tip Jack, Red	J-0066
TP4	Tip Jack, Black	J-0067
	Heatsinks, Q1 and Q2	X-1008
	Transistor Mounting Pads	E-0218
	Shield Cans, L8, L9, L10	6611-0319

NOTE:

- COMPONENTS SHOWN IN SOLID BLACK
- FACING SIDE FOIL SHOWN IN BLACK SCREEN
- OPPOSITE SIDE FOIL SHOWN IN RED SCREEN

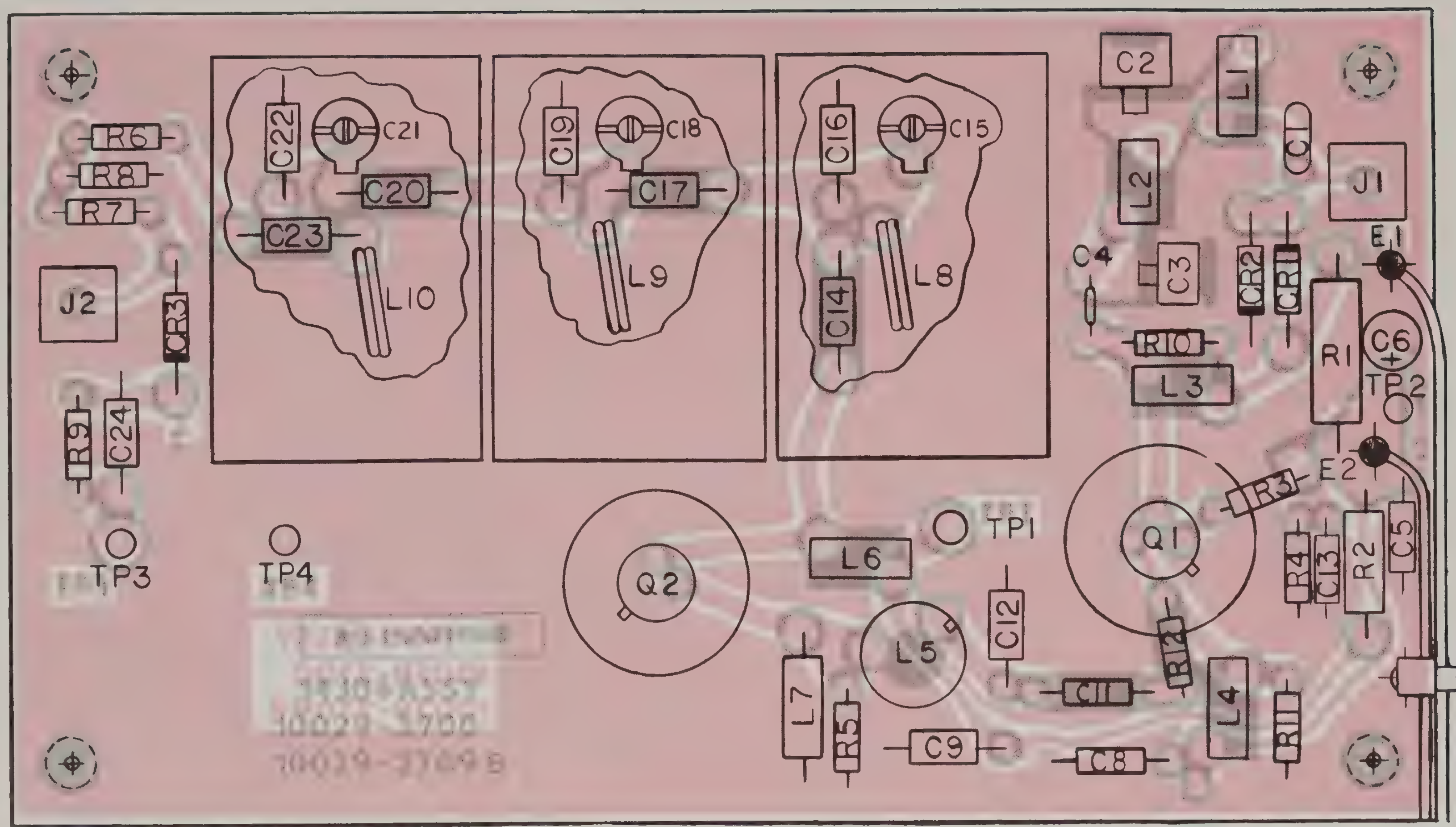
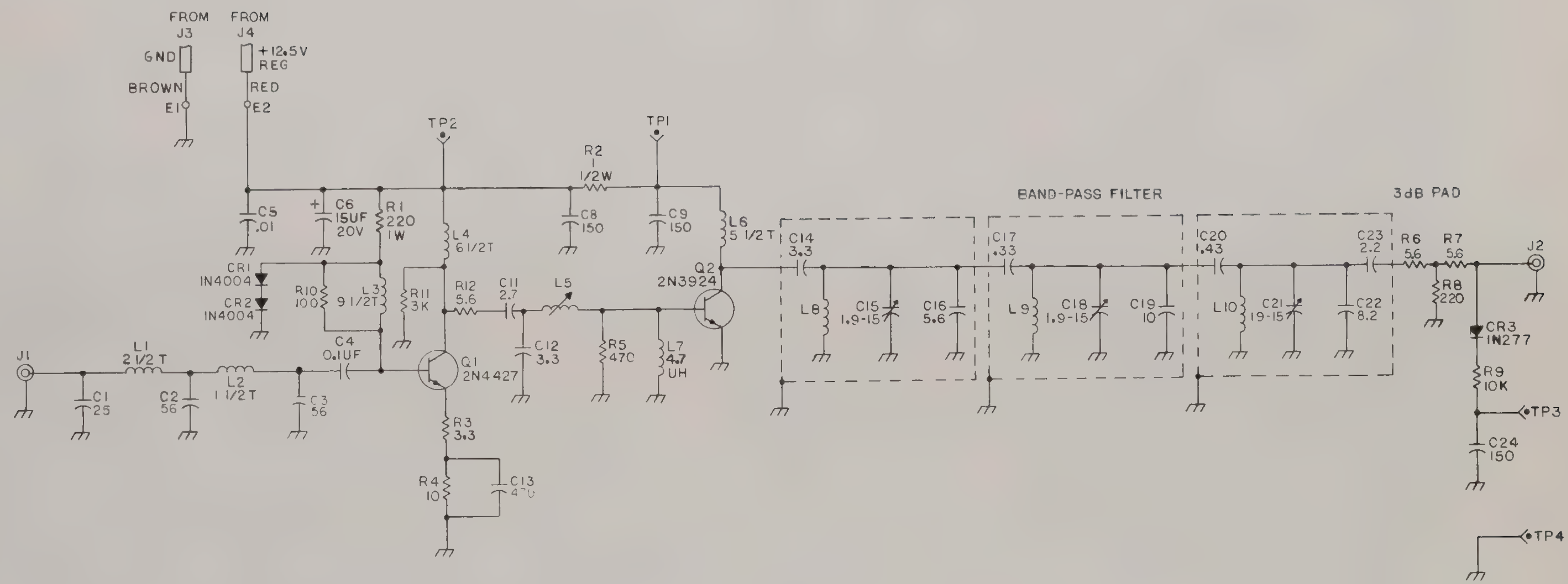


Figure 5. VHF Tx Exciter Module, Component Location Diagram

NOTES: UNLESS OTHERWISE SPECIFIED:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER AND/OR ASSEMBLY DESIGNATION.
2. RESISTOR VALUES ARE IN OHMS, 1/4W, 5%
3. CAPACITOR VALUES ARE IN PICOFARADS.
4. VENDOR AND/OR JEDEC PART NUMBER CALLOUTS ARE FOR REFERENCE ONLY; COMPONENTS ARE SUPPLIED PER PART NUMBER IN PARTS LIST.



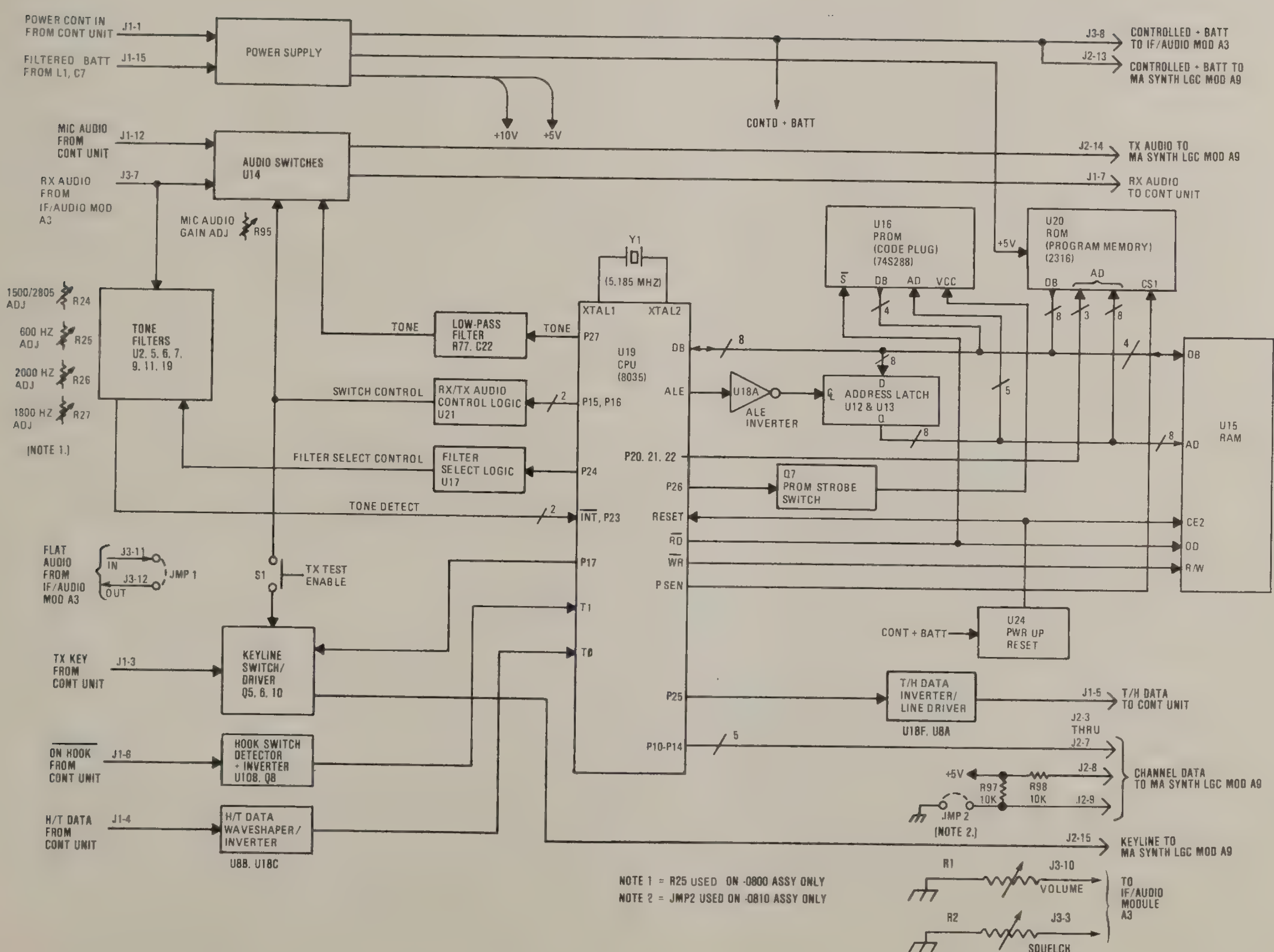
HIGHEST REFERENCE DESIGNATION					
C24	L10	R12	J4	TP4	CR3
Q2	E2				
REFERENCE DESIGNATION NOT USED					
C10	C7				

Figure 6. VHF TX Exciter Module, Schematic Diagram

A8

INTFC LGC MOD

IMTS/MTS: 10029-0800
IMTS/2805: 10029-0810



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LIST OF TABLES

1. GENERAL DESCRIPTION

1.01 This tab section covers the IMTS/MTS and IMTS/2805 Interface Logic Modules 10029-0800 and 10029-0810, and the Alpha 40 Control Unit. The major input/output signal functions of Interface Logic Module A8 are shown on the tab cover functional diagram and detailed block diagram figure 1. The 0800/0810 Interface Logic Modules in conjunction with the Control Unit, direct operation of the Transceiver in the mobile telephone system in which they are operating.

1.02 Microprocessor U19 is the most important single component in the Interface Logic Module. All other components are associated with the inputs and outputs of the microprocessor. The program which directs the operation of the microprocessor is contained in Read-Only Memory (ROM) U20. This program is fixed by the manufacturer and it directs the microprocessor to perform the many functions required of the Interface Logic Module.

1.03 This tab section explains how the 0800/0810 Interface Logic Modules work in the IMTS/MTS (TELCO) and IMTS/2805 (RCC) mobile telephone systems. Operation and maintenance of the Alpha 40 Control Unit (i.e. Handset and Cradle) is also described.

2. INTERFACE CONNECTIONS

2.01 The interface connections for both the IMTS/MTS (0800) and the IMTS/2805 (0810) Interface Logic Modules are identical. Table 1 summarizes all Interface Logic Module connections and gives significant TO/FROM information.

SEE TABLE 3 FOR HANDSET INTERFACE CONNECTIONS

TABLE 1

Interface Logic Module, (0800/0810) Interface Connections

REF DESIG	FUNCTION	TO	FROM
J1-1	Pwr Cont In (+12V)	—	J4-1*
J1-2	(Key)	N/C	N/C
J1-3	Tx Key In/Out (+12V Active)	—	J4-2*
J1-4	H/T Data In (Serial Logic; +6.7V High, +2.0V Low)	—	J4-3*
J1-5	T/H Data Out (Serial Data; +4.3V Threshold)	J4-5*	—
J1-6	On Hook (+12V Active)	—	J4-6*
J1-7	Rcv Audio Out (4.7K ohms, termination)	J4-7*	—
J1-8	Spare	N/A	N/A
J1-9	Logic Gnd	—	J4-9*
J1-10	Cradle Gnd	—	J4-13*
J1-11	Spare	N/A	N/A
J1-12	Tx Audio In (100 MA Source Cur., DC with ≈ +4.3V bias, Coupling)	—	J4-12*
J1-13	Spare	N/A	N/A
J1-14	Audio Shield	—	J4-10*

*TO/FROM Cradle Assembly Connector via Transceiver Control Connector J2.

TABLE 1

Interface Logic Module, (0800/0810) Interface Connections (Cont.)

REF DESIG	FUNCTION	TO	FROM
J1-15	+Batt In (+13.6V)	—	+C7/L1 (PLUS)
J1-16	−Batt In (Gnd)	—	−C7 (MINUS)
J2-1	Not used	N/A	N/A
J2-2	O/L In (+5V Active)	—	A9J1-11
J2-3	Chan Data Out, Bit A	A9J1-10	—
J2-4	Chan Data Out, Bit B	A9J1-9	—
J2-5	Chan Data Out, Bit C	A9J1-8	—
J2-6	Chan Data Out, Bit D	A9J1-7	—
J2-7	Chan Data Out, Bit E	A9J1-6	—
J2-8	VHF/$\overline{\text{UHF}}$ (VHF = 5V UHF = 0)	A9J1-5	—
J2-9	TELCO/$\overline{\text{RCC}}$ (TELCO = 5V, RCC = 0)	A9J1-4	—
J2-10	Gnd	A9J1-3	—
J2-11	Not Used	N/C	N/C
J2-12	Spare	A9J2-1	A9J2-1
J2-13	Contd + Batt Out	A9J2-6	—
J2-14	Tx Audio Out	A9J2-5	—
J2-15	Tx Key Out	A9J2-4	—
J2-16	Gnd	A9J2-3	—

TABLE 1 (Cont.)

REF DESIG	FUNCTION	TO	FROM
J2-17	(Key)	N/C	N/C
J2-18	Not Used	—	A9J2-1
J3-1	−Disc	—	A3J1-16
J3-2	+Disc	—	A3J1-15
J3-3	Squelch Control (Wiper)	A3J1-14	—
J3-4	Signal Strength In	—	A3J1-13
J3-5	Sq Ctrl High	—	—
J3-6	Channel Active In	—	A3J1-11
J3p7	Processed Audio In	—	A3J1-10
J3-8	Contd +Batt Out	A3J1-9	—
J3-9	Mute Out	A3J1-8	—
J3-10	Volume Control (Wiper)	A3J1-7	—
J3-11	Flat Audio In	—	A3J1-6
J3-12	Audio Out	A3J1-5	—
J3-13	Mixer Tp	—	A3J1-4
J3-14	Gnd	—	A3J1-3
J3-15	(Key)	N/C	N/C
J3-16	Vol Ctrl High	—	—
J4-1	Gnd Tp	—	Gnd
J4-2	(Key)	N/C	N/C
J4-3	+Batt	—	A8J1-15
J4-4	Contd + Batt Out	—	A8Q1-C
J4-5	Tx Keyline	—	A8J2-15

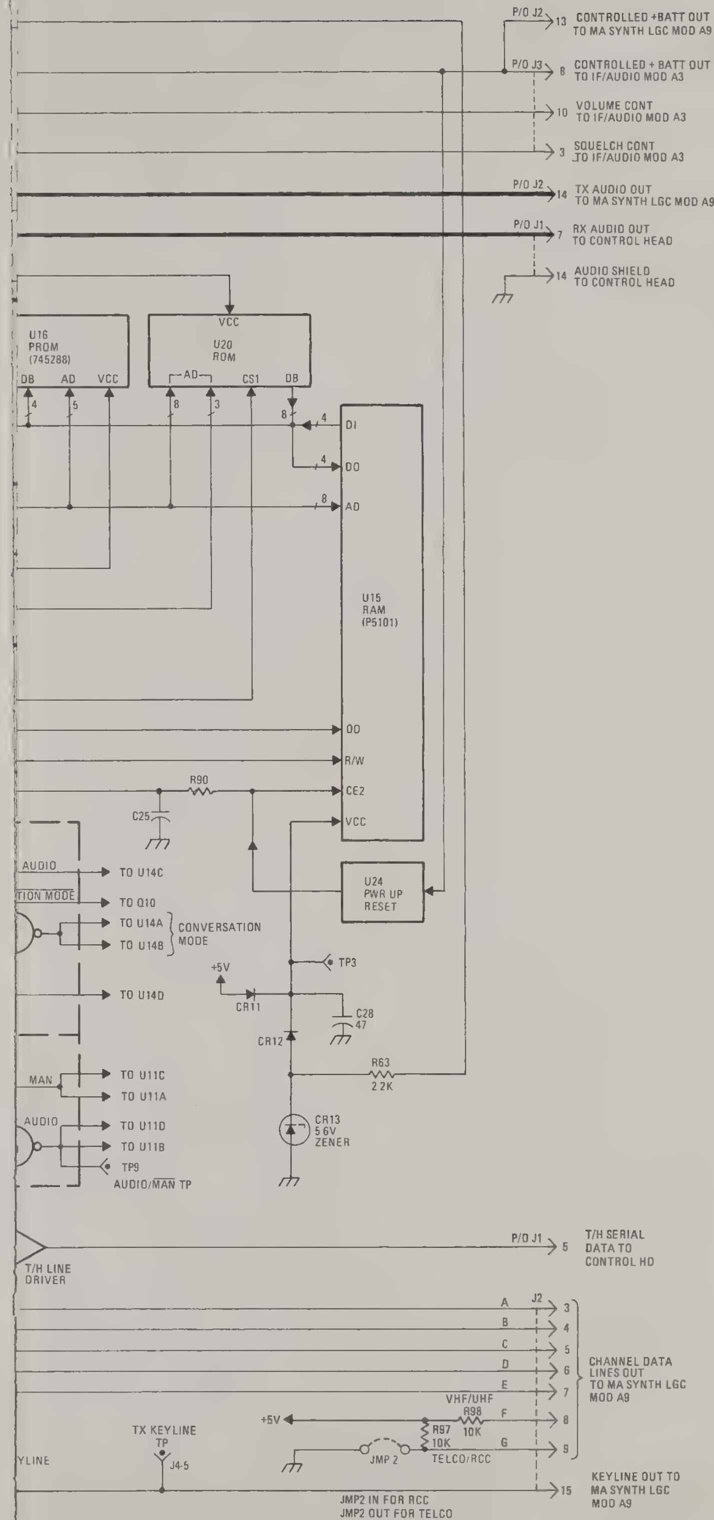


Figure 1. Interface Logic Module, Simplified Diagram

TABLE 1

Interface Logic Module, (0800/0810) Interface Connections (Cont.)

REF DESIG	FUNCTION	TO	FROM
J1-15	+Batt In (+13.6V)	—	+C7/L1 (PLUS)
J1-16	−Batt In (Gnd)	—	−C7 (MINUS)
J2-1	Not used	N/A	N/A
J2-2	O/L In (+5V Active)	—	A9J1-11
J2-3	Chan Data Out, Bit A	A9J1-10	—
J2-4	Chan Data Out, Bit B	A9J1-9	—
J2-5	Chan Data Out, Bit C	A9J1-8	—
J2-6	Chan Data Out, Bit D	A9J1-7	—
J2-7	Chan Data Out, Bit E	A9J1-6	—
J2-8	VHF/$\overline{\text{UHF}}$ (VHF = 5V UHF = 0)	A9J1-5	—
J2-9	TELCO/$\overline{\text{RCC}}$ (TELCO = 5V, RCC = 0)	A9J1-4	—
J2-10	Gnd	A9J1-3	—
J2-11	Not Used	N/C	N/C
J2-12	Spare	A9J2-1	A9J2-1
J2-13	Contd + Batt Out	A9J2-6	—
J2-14	Tx Audio Out	A9J2-5	—
J2-15	Tx Key Out	A9J2-4	—
J2-16	Gnd	A9J2-3	—

TABLE 1 (Cont.)

REF DESIG	FUNCTION	TO	FROM
J2-17	(Key)	N/C	N/C
J2-18	Not Used	—	A9J2-1
J3-1	−Disc	—	A3J1-16
J3-2	+Disc	—	A3J1-15
J3-3	Squelch Control (Wiper)	A3J1-14	—
J3-4	Signal Strength In	—	A3J1-13
J3-5	Sq Ctrl High	—	—
J3-6	Channel Active In	—	A3J1-11
J3p7	Processed Audio In	—	A3J1-10
J3-8	Contd +Batt Out	A3J1-9	—
J3-9	Mute Out	A3J1-8	—
J3-10	Volume Control (Wiper)	A3J1-7	—
J3-11	Flat Audio In	—	A3J1-6
J3-12	Audio Out	A3J1-5	—
J3-13	Mixer Tp	—	A3J1-4
J3-14	Gnd	—	A3J1-3
J3-15	(Key)	N/C	N/C
J3-16	Vol Ctrl High	—	—
J4-1	Gnd Tp	—	Gnd
J4-2	(Key)	N/C	N/C
J4-3	+Batt	—	A8J1-15
J4-4	Contd + Batt Out	—	A8Q1-C
J4-5	Tx Keyline	—	A8J2-15

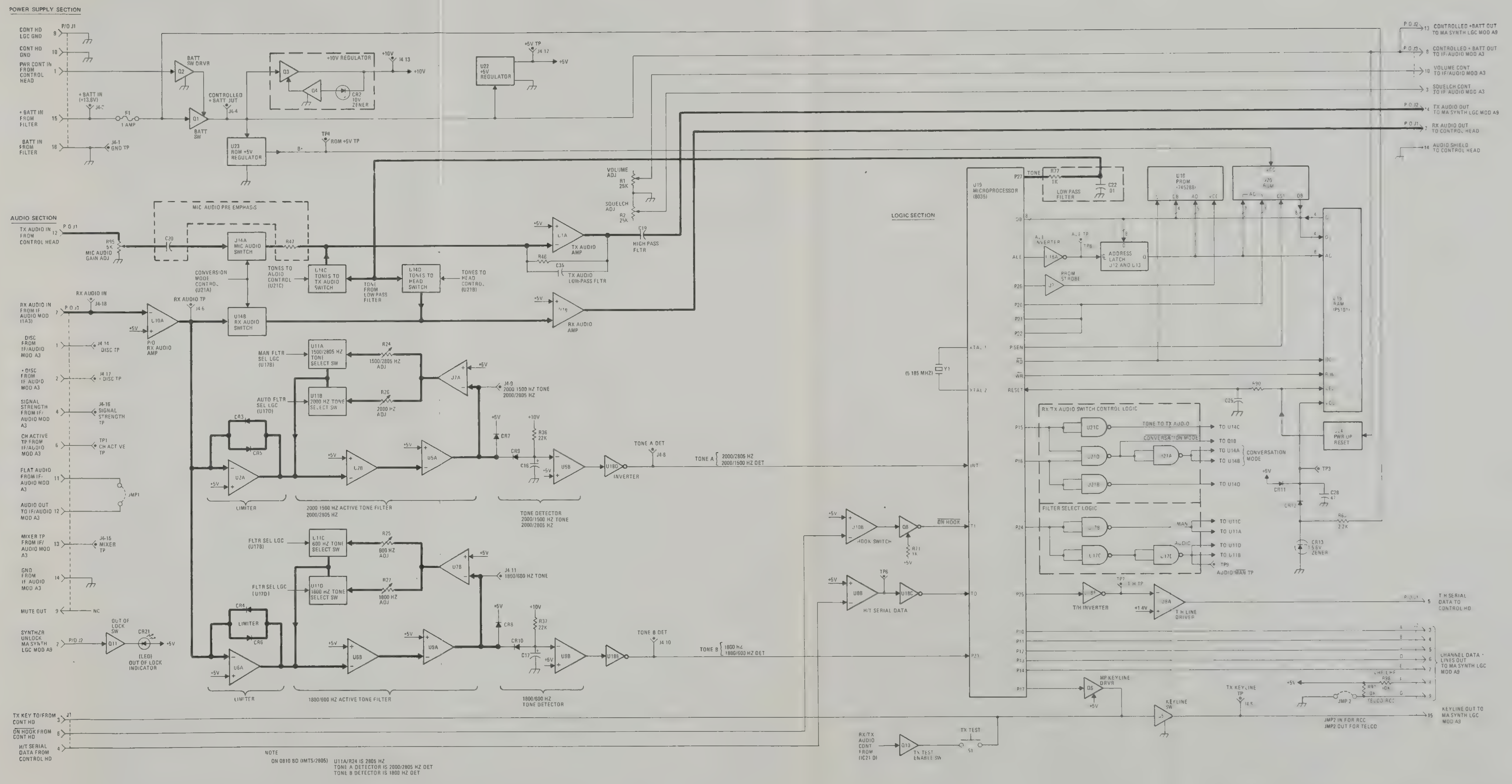


Figure 1. Interface Logic Module, Simplified Diagram

TABLE 1

Interface Logic Module, (0800/0810) Interface Connections (Cont.)

REF DESIG	FUNCTION	TO	FROM
J4-6	Rx Audio	—	A8U10A-1
J4-7	Spare	—	N/C
J4-8	Tone A Det	—	A8U18D-10
J4-9	Tone A	—	A8U5A-1
J4-10	Tone B Det	—	A8U18E-12
J4-11	Tone B	—	A8U9A-1
J4-12	+5V Reg	—	A8U22-E
J4-13	+10V Reg	—	A8C3(+)
J4-14	−Disc	—	A8J3-1
J4-15	Mixer	—	A8J3-13
J4-16	Signal Strength	—	A8J3-4
J4-17	+Disc	—	A8J3-2
J4-18	Rx Audio In	—	A8J3-7

3. SUPPLEMENTARY SEMICONDUCTOR DATA

3.01 Supplementary semiconductor data for both IMTS/MTS (0800) and IMTS/2805 (0810) Interface Logic Modules, are included in Chapter 4, Maintenance, for the following complex devices listed in table 2.

TABLE 2

Interface Logic Module, (0800/0810) Complex Semiconductor Devices

REF DESIG	DEVICE	TYPE
U1	MC1458CP	Dual OP-AMP
U2	CA3240E	Dual OP-AMP
U3	Not Used	—
U4	Not Used	—

TABLE 2 (Cont.)

REF DESIG	DEVICE	TYPE
U5	CA3240E	Dual OP-AMP
U6	CA3240E	Dual OP-AMP
U7	CA3240E	Dual OP-AMP
U8	MC1458CP	OP-AMP
U9	CA3240E	Dual OP-AMP
U10	MC1458CP	Dual OP-AMP
U11	CD4066BE	Quad Bilateral Switch
U12	SN74LS175	Quad Latch
U13	SN74LS175	Quad Latch
U14	CD4066BE	Quad Bilateral Switch
U15	MCM145101P	1024 Bit Static RAM
U16	SN74S288	PROM (CODE PLUG)
U17	SN74LS26N	QUAD 2-Input NAND Gate
U18	CD4049BE	HEX BUFFER (Inverting)
U19	8035	8-Bit Micro-processor
U20	6624-1187	ROM (PROGRAM MEMORY)
U21	SN74LS26N	Quad 2-Input NAND Gate
U22	MC7805CT	+5 Volt Regulator
U23	MC7805CT	+5 Volt Regulator
U24	ICL8211CPA	Micro Power Voltage Detector

4. TECHNICAL DESCRIPTION

A. The IMTS System

4.01 The IMTS system consists of a Telephone Central Office, a Base Station and a number of Mobile Units (figure 2). The Base Station and Telephone Central Office are connected by a two-way landline link, while the Base Station is connected to each Mobile Unit by a two-way radio link.

4.02 The Terminal in the Base Station controls the operation of the Base Station Transmitter. An Idle tone is transmitted to indicate to the Mobile Units the channel available for calls. A Seize tone is transmitted when the channel is first activated. The Seize tone is interrupted by the Idle tone to signal a mobile number and to initiate the ringing signal in the Mobile Unit.

4.03 The Control Unit and Interface Logic Module determines the operation of the Mobile Transceiver. It decodes signals from the Base Station, and generates signals which are then transmitted to the Base Station. Specifically, the Interface Logic Module does the following:

- Scans the available channels to locate the Idle tone, and then locks to that channel.
- Sends an Acknowledge tone when it decodes the telephone number transmitted by the Base Station.
- Upon receipt of a Ring signal, activates an Alert tone and shows the word CALL in the Handset display.
- Sends a Connect tone sequence when the Mobile Unit answers a call.

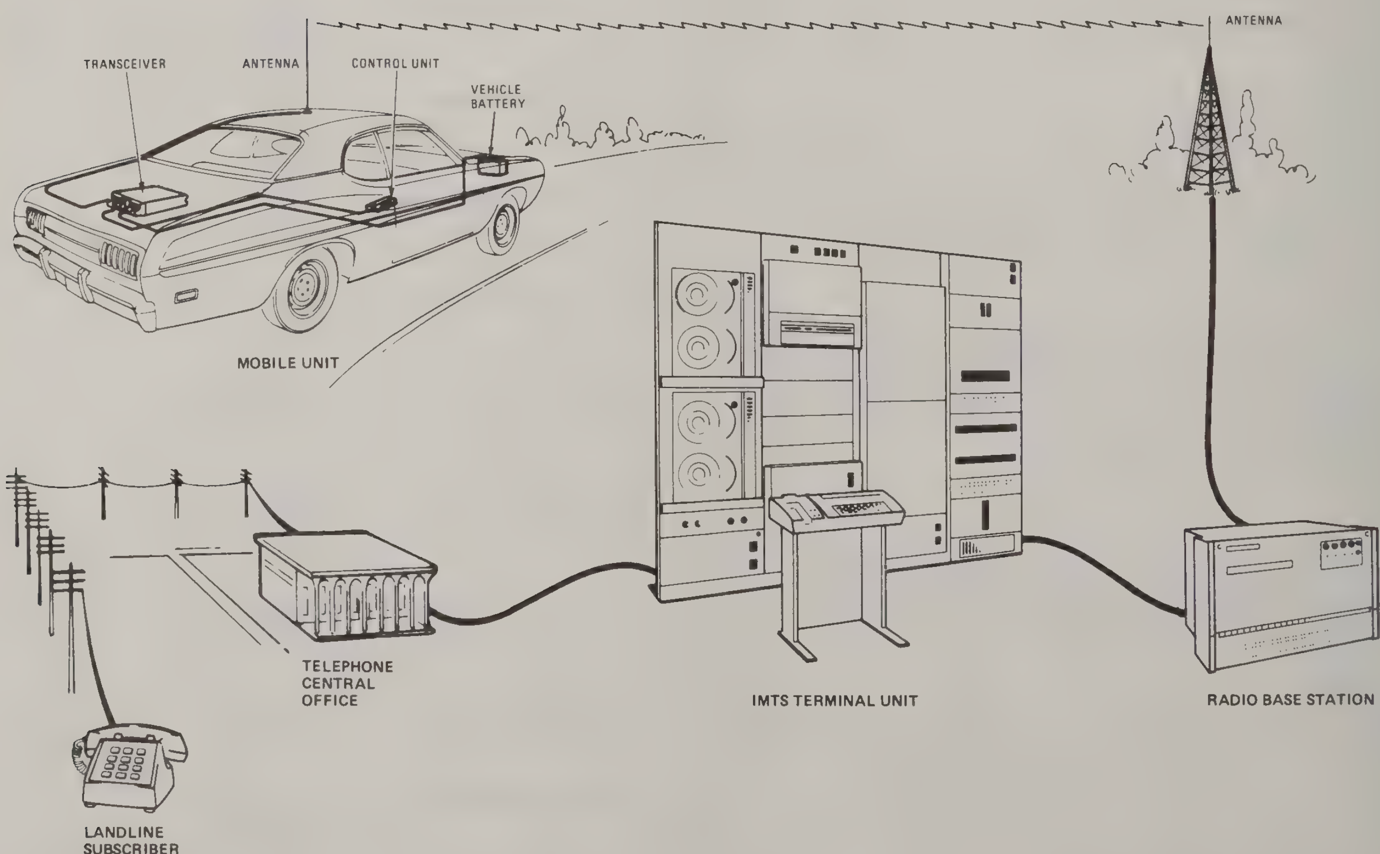


Figure 2. IMTS System

- Sends a Disconnect tone sequence when the Mobile Unit completes the call.
- When the Mobile Unit initiates a call, sends a Connect tone sequence and its own Identification Number.
- Provides visual indication when the Mobile Unit is transmitting.
- Displays BUSY and gives an audible 'busy' signal if all channels are busy, when a Mobile Unit initiates a call.

Landline-to-Mobile Call Sequence

4.04 When a call destined for a Mobile Unit, is received at the terminal (from either the Telephone Central Office or another Mobile Unit) the Terminal replaces the Idle tone by the Seize tone. It then transmits the Idle tone on another vacant channel. The Mobile Units previously locked to the Idle tone now remains locked to the Seize tone. The Base Station, then transmits the telephone number of the desired Mobile Unit. The signal is produced by interrupting the Seize tone with the Idle tone. Each shift from the Seize to the Idle tone represents one count.

4.05 All the Mobile Units receive the number but only one is able to decode the complete signal. As the number is decoded each of the other Mobile Units reverts to scanning channels for the Idle tone, as soon as a mismatch is detected. After the number has been decoded, the Mobile Unit automatically transmits an Acknowledge signal. Upon receipt of this signal, the Base Station transmits a Ring signal (alternating bursts of Idle and Seize tones). When this signal is received, the Mobile Unit generates an Alert tone and the word CALL is displayed. Removal of the Handset initiates a burst of Connect tone. The Terminal responds by removing the Ring signal and opening the conversation path.

4.06 When the call is completed by replacing the Handset on-hook (or depressing the SEL and END keys) a Disconnect tone sequence is transmitted. This indicates to the Base Station that the channel has been vacated. At this time the Mobile Unit resumes scanning channels for the Idle tone.

4.07 If the incoming call is not answered within the base ringing sequence, the Alert tone is terminated, but the word CALL remains displayed. The Mobile Unit resumes scanning channels for the Idle tone.

Mobile-to-Landline Call Sequence

4.08 When a call is initiated, the Mobile Unit is already locked to an Idle-marked channel. After the phone number is entered and the Handset is taken off-hook or SND is depressed, a Connect tone sequence is automatically transmitted. The Base Station receives this signal and transfers the Idle tone to another free channel. Then a burst of SEIZE tone is transmitted to the Mobile Unit. When the Seize tone ends, the Mobile Unit sends its ANI (Automatic Number Identification). If the number is valid, the Terminal transmits a Dial tone. The mobile subscriber may then dial the desired number. Replacing the Handset, initiates a Disconnect sequence. This indicates to the Base Station that the channel has been vacated. The Mobile Unit then resumes scanning channels for the Idle tone.

B. The Manual Mode of Operation

Landline-to-Mobile Call Sequence

4.09 In the Manual mode a Mobile Unit is called by an Automatic Terminal or another Mobile Unit. The Base Station transmits the bursts of tone produced by dialing, but only one Mobile Unit can decode them. Successful decoding is followed by an Alert tone and a CALL indication in the display. If the call is not answered the Alert tone is disconnected, but the CALL activation remains. The unit will remain locked to the calling channel for approximately 45 seconds before resuming scanning.

Mobile-to-Landline Call Sequence

4.10 The Mobile subscriber must search for an unoccupied channel and then signal the Base Station by using the PTT (Push-To-Talk) bar. The mobile operator answers and places the call as requested.

4.11 In semi-automatic 2805 Hz (RCC) systems, the mobile operator is bypassed by dialing a preselected digit which permits access to the landline.

C. IMTS Block Diagrams

4.12 Figures 3 through 12 illustrate, in the form of block diagrams, the following functions performed by the Interface Logic Module and the Alpha 40 Control Unit.

(a) Channel scanning (Figure 3)

(b) Detection of an Idle-marked channel (Figure 4)

(c) Landline-to-Mobile Call Sequence

(1) Seizing by Base Station (Figure 5)

(2) Base Station Outpulsing of identification number and transmission of Acknowledge signal by Mobile Unit. (Figure 6)

(3) Ringing by Base Station. (Figure 7)

(4) Connect mode. (Figure 8)

(5) Disconnect mode. (Figure 9)

(d) Mobile-to-Landline Call Sequence

(1) Connect mode. (Figure 10)

(2) Transmission of ANI. (Figure 11)

(3) Dialing. (Figure 12)

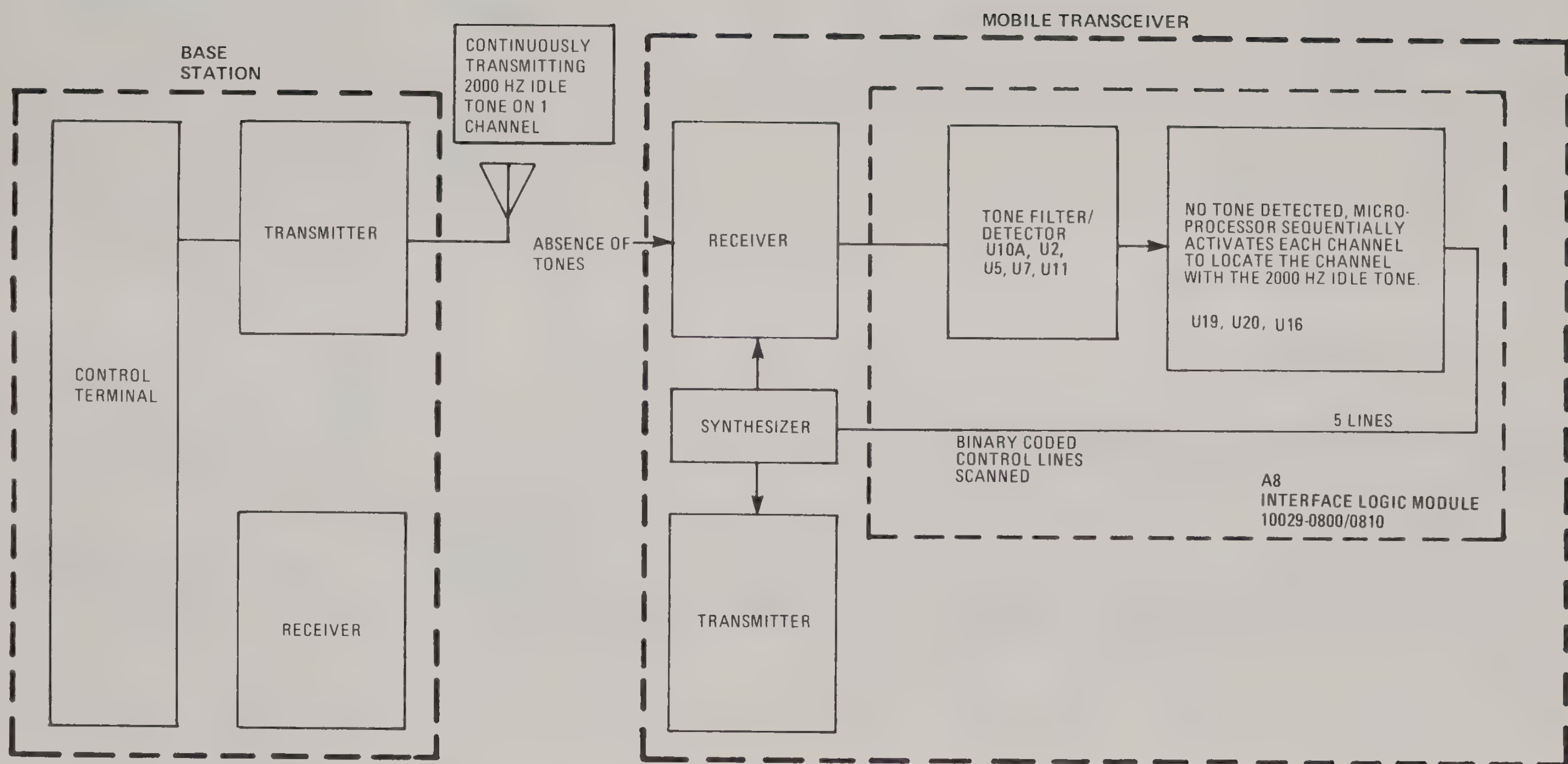


Figure 3. Functional Block Diagram, Channel Scanning

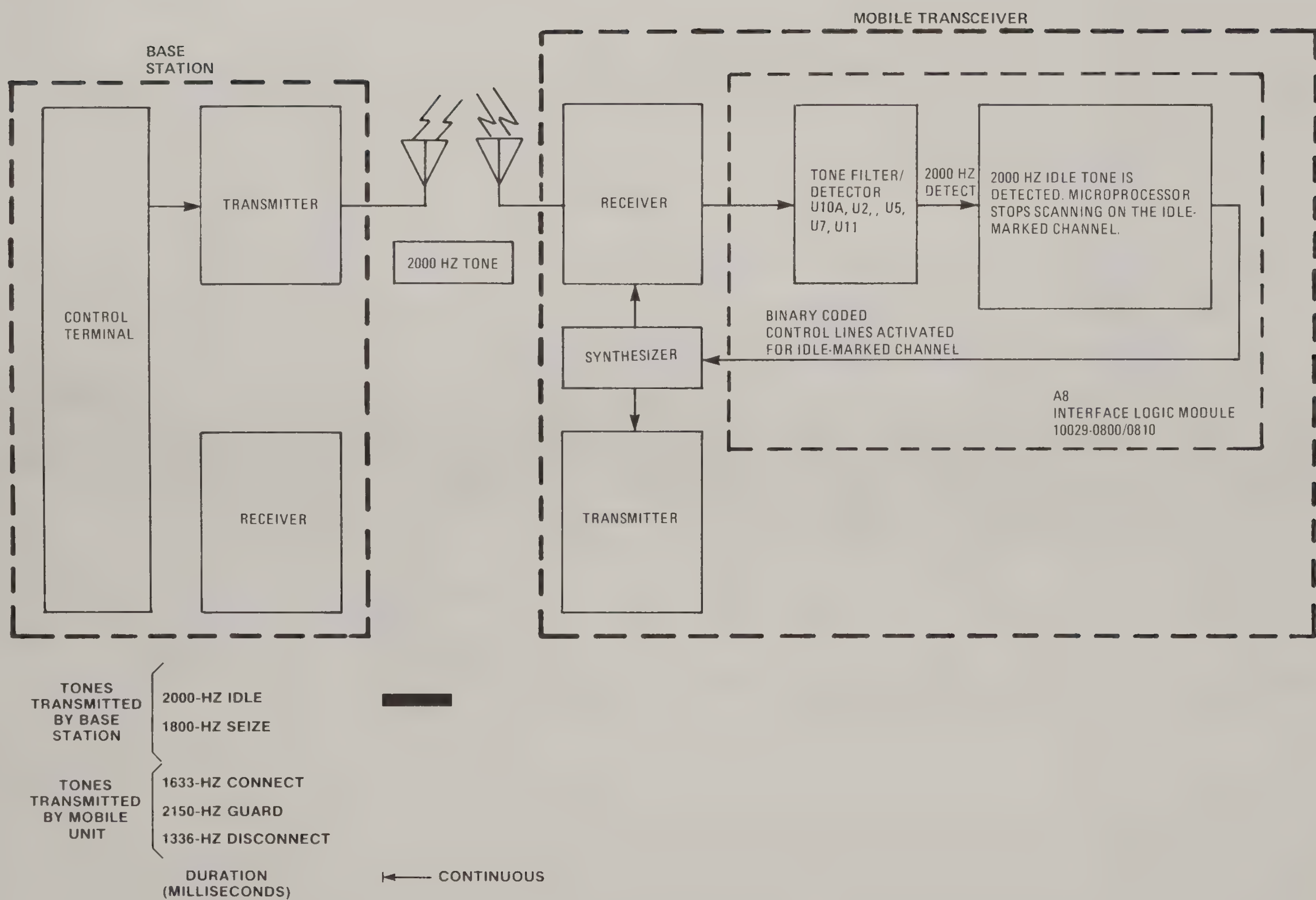


Figure 4. Functional Block Diagram, Detection of Idle-marked Channel

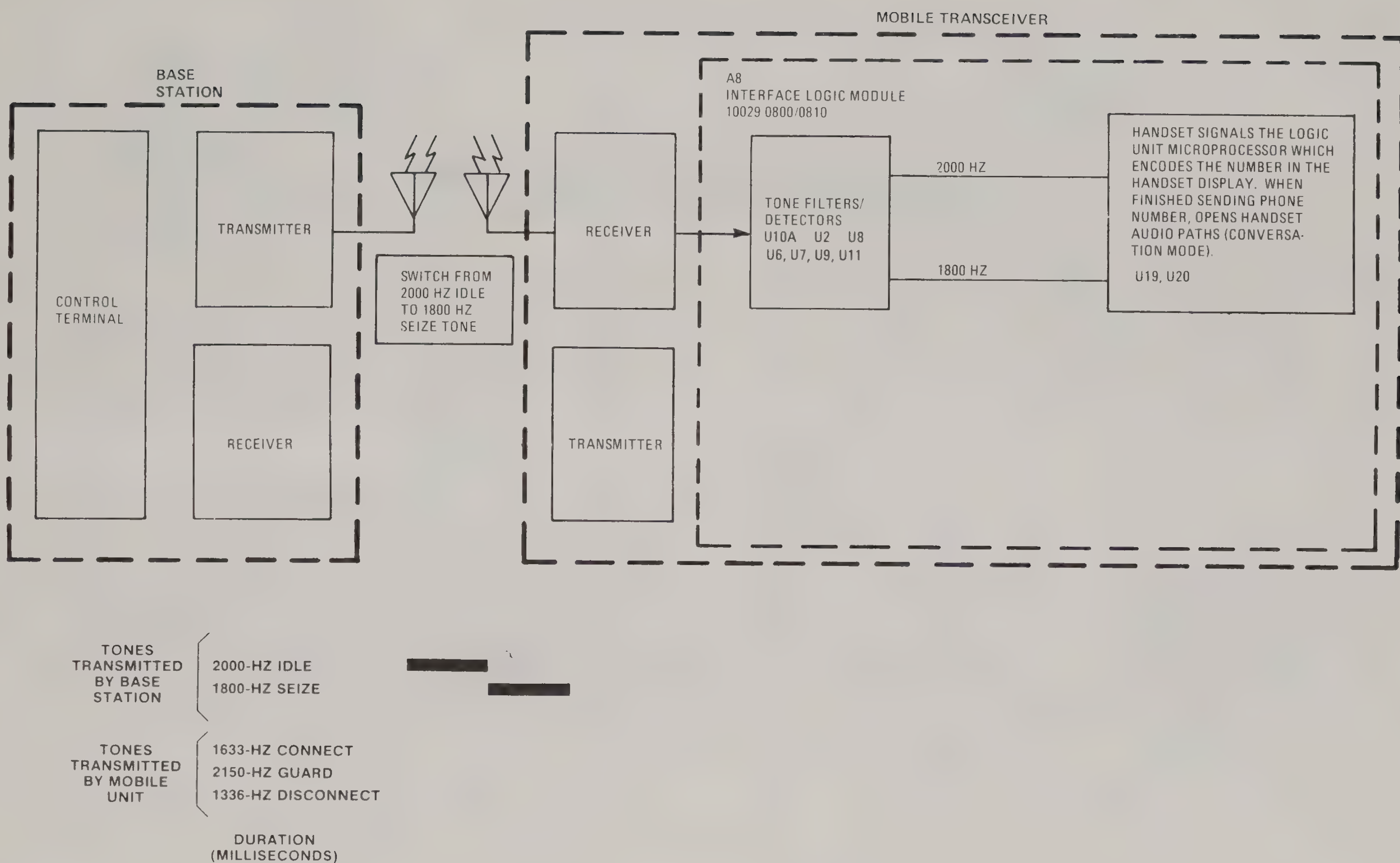


Figure 5. Functional Block Diagram, IMTS Mode, Landline-to-Mobile Call Sequence, Seizing by Base Station

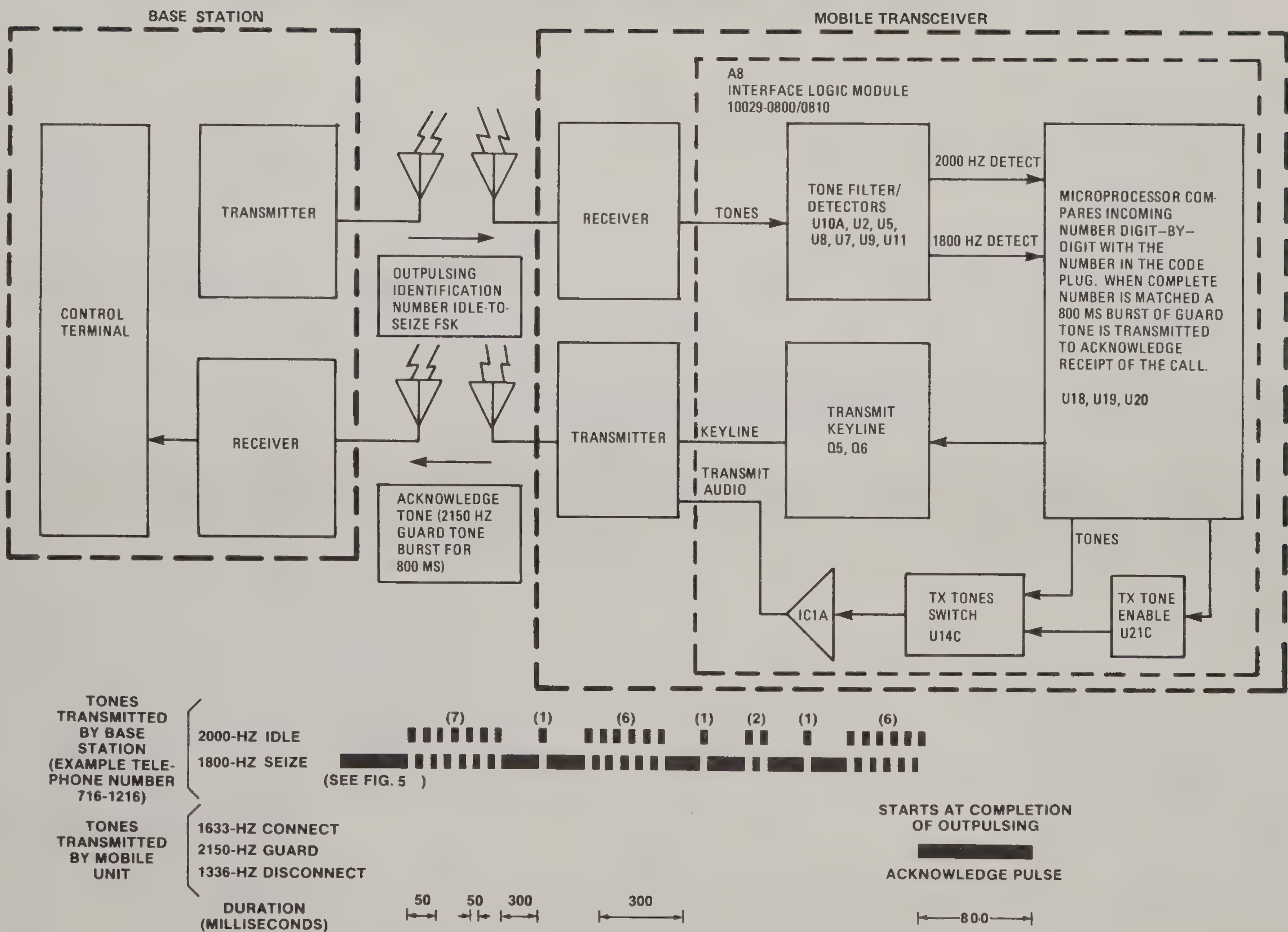


Figure 6. Functional Block Diagram, IMTS Mode, Landline-to-Mobile Call Sequence, Outpulsing of Identification Number by Base Station and Acknowledgement by Mobile Unit

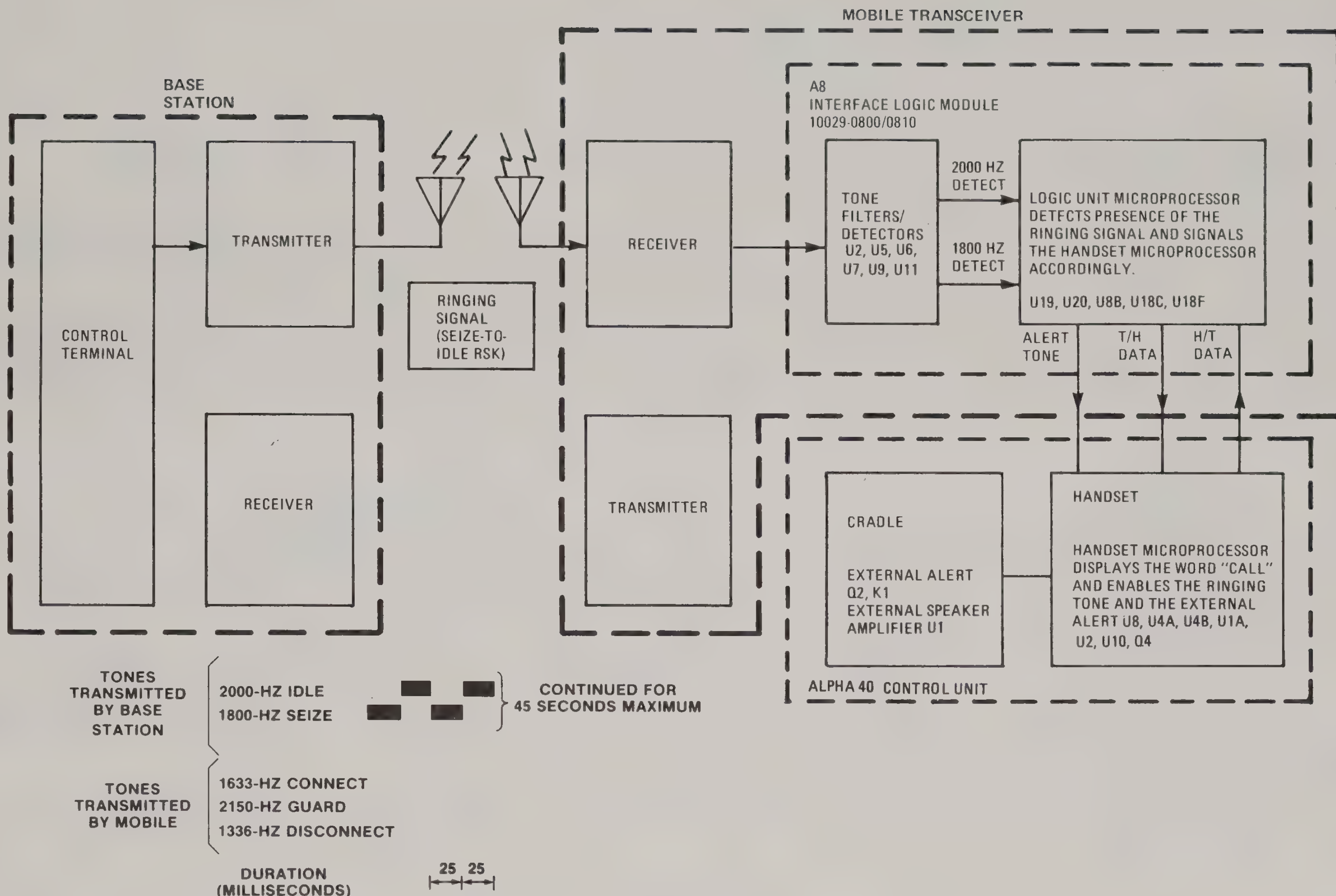


Figure 7. Functional Block Diagram, IMTS Mode, Landline-to-Mobile Call Sequence, Ringing Signal

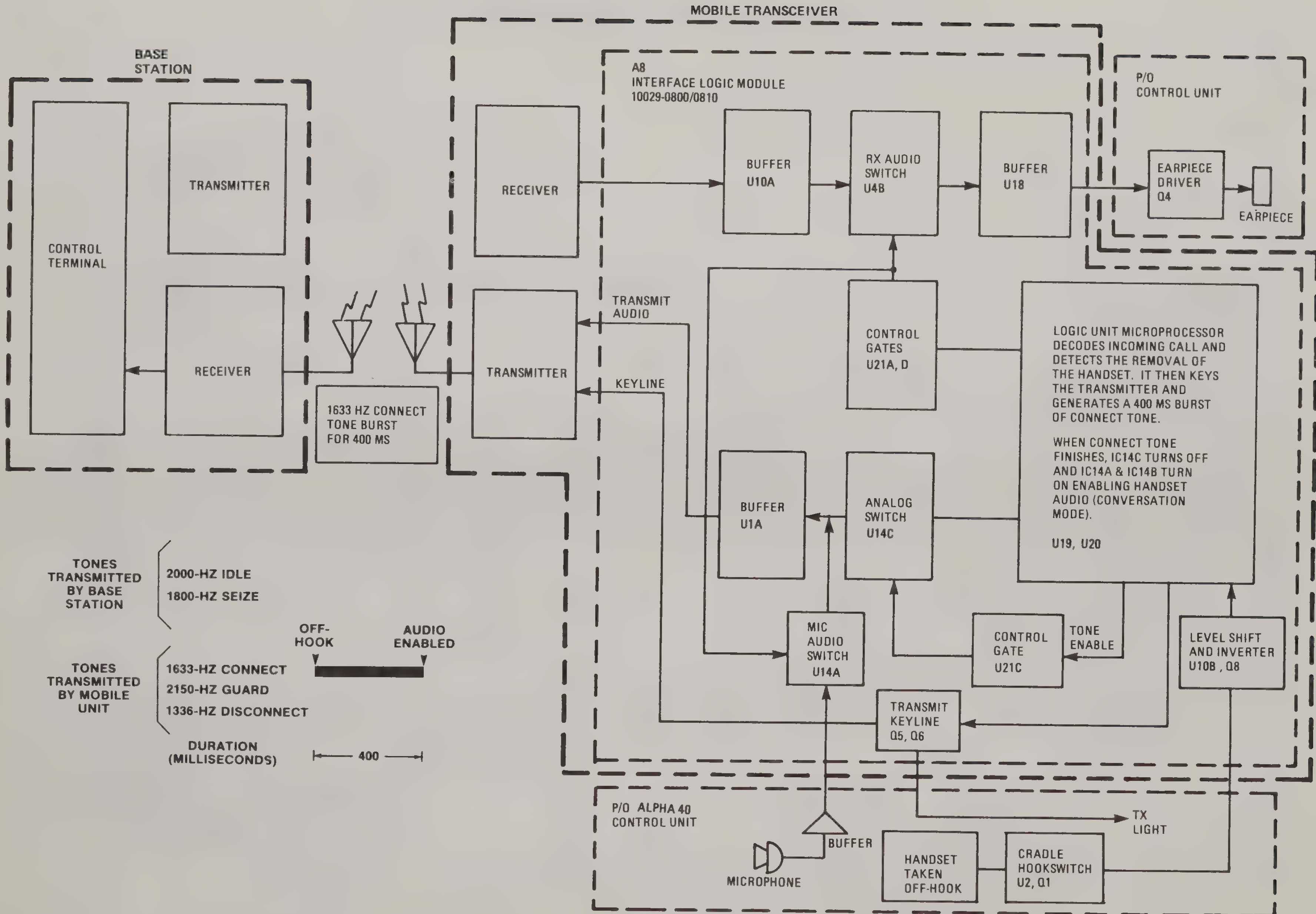


Figure 8. Functional Block Diagram, IMTS Mode, Landline-to-Mobile Call Sequence, Connect

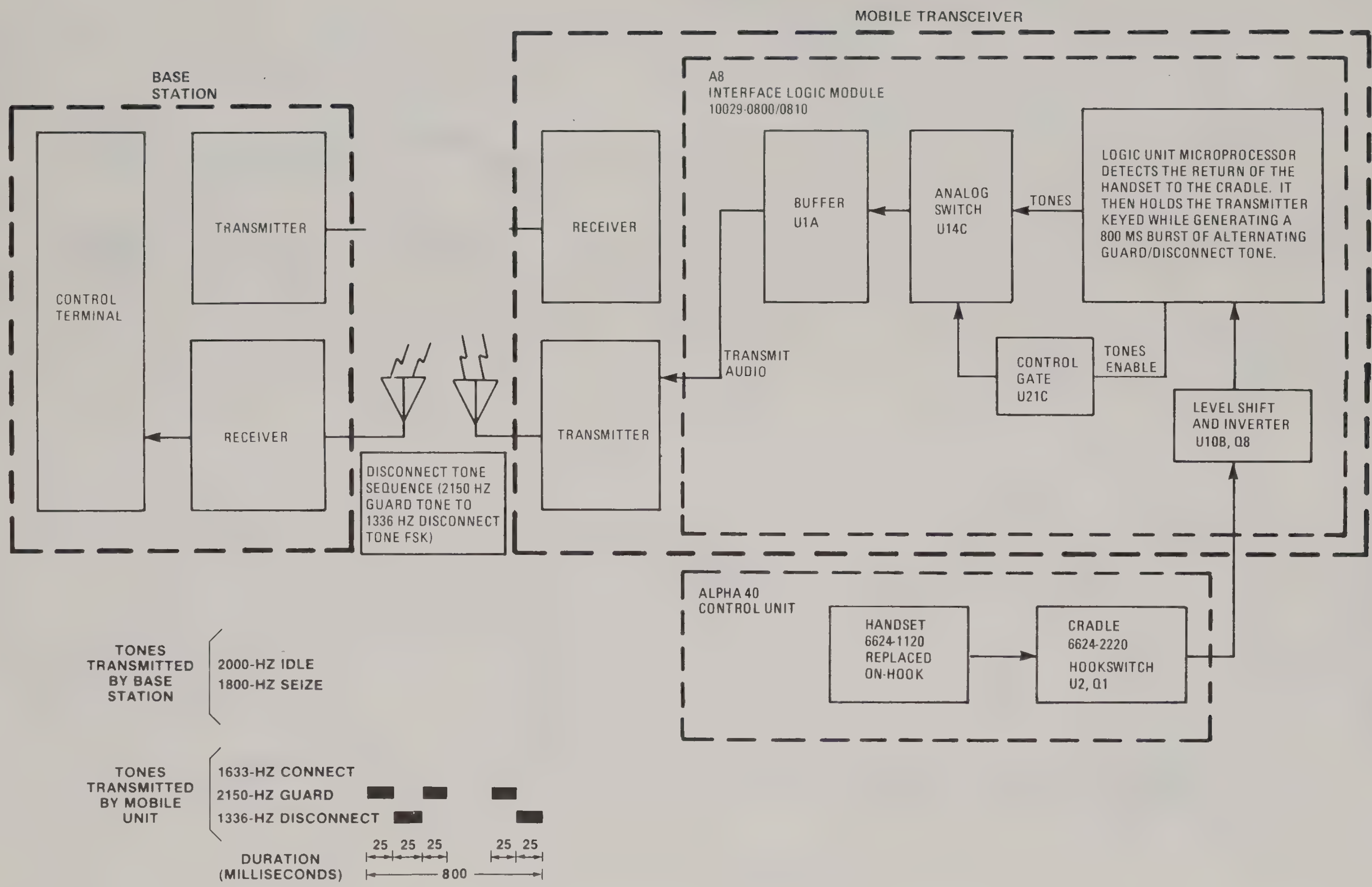


Figure 9. Functional Block Diagram, IMTS Mode, Landline-to-Mobile Call Sequence, Disconnect

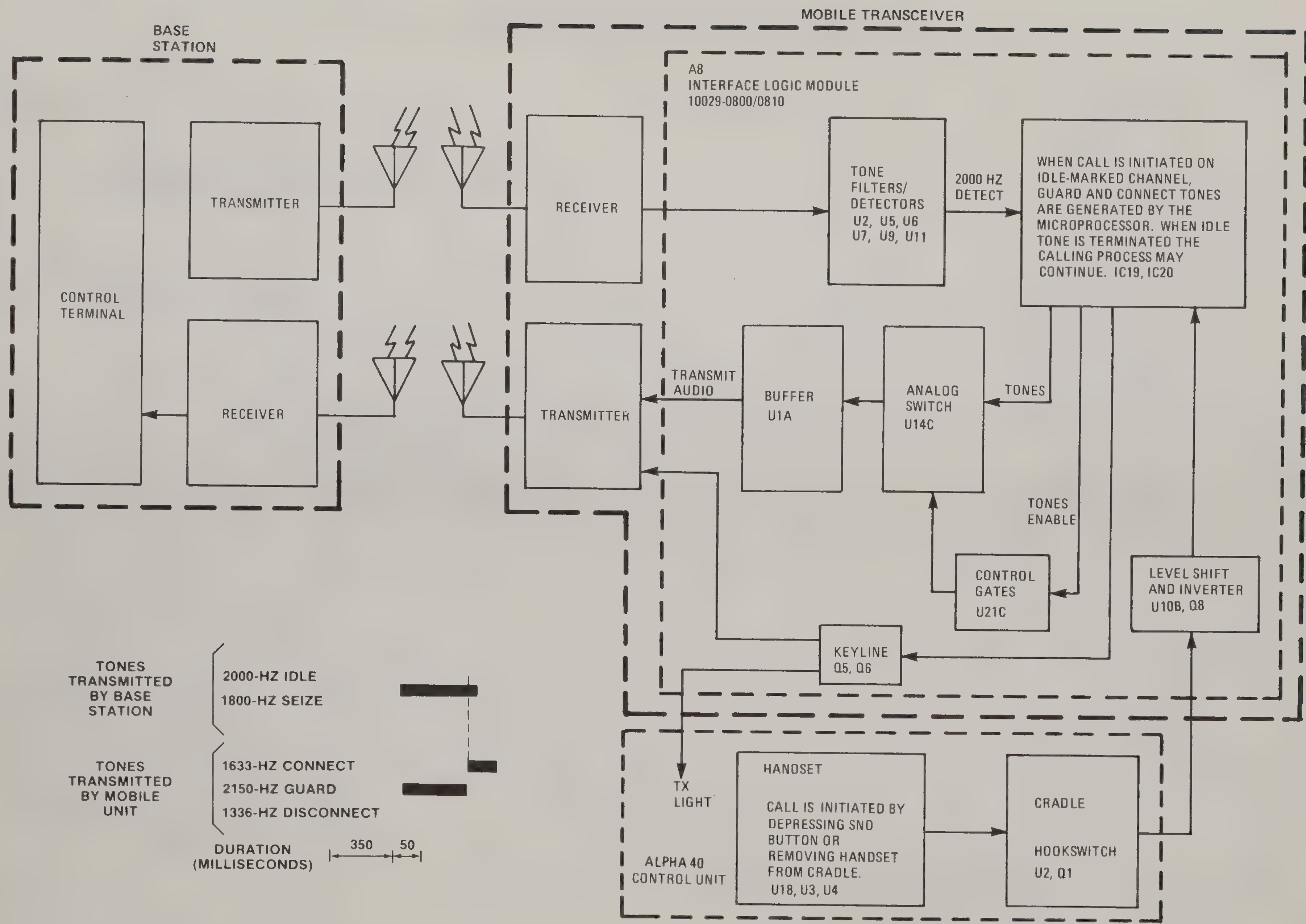


Figure 10. Functional Block Diagram, IMTS Modern Mobile-to-Landline Call Sequence, Connect

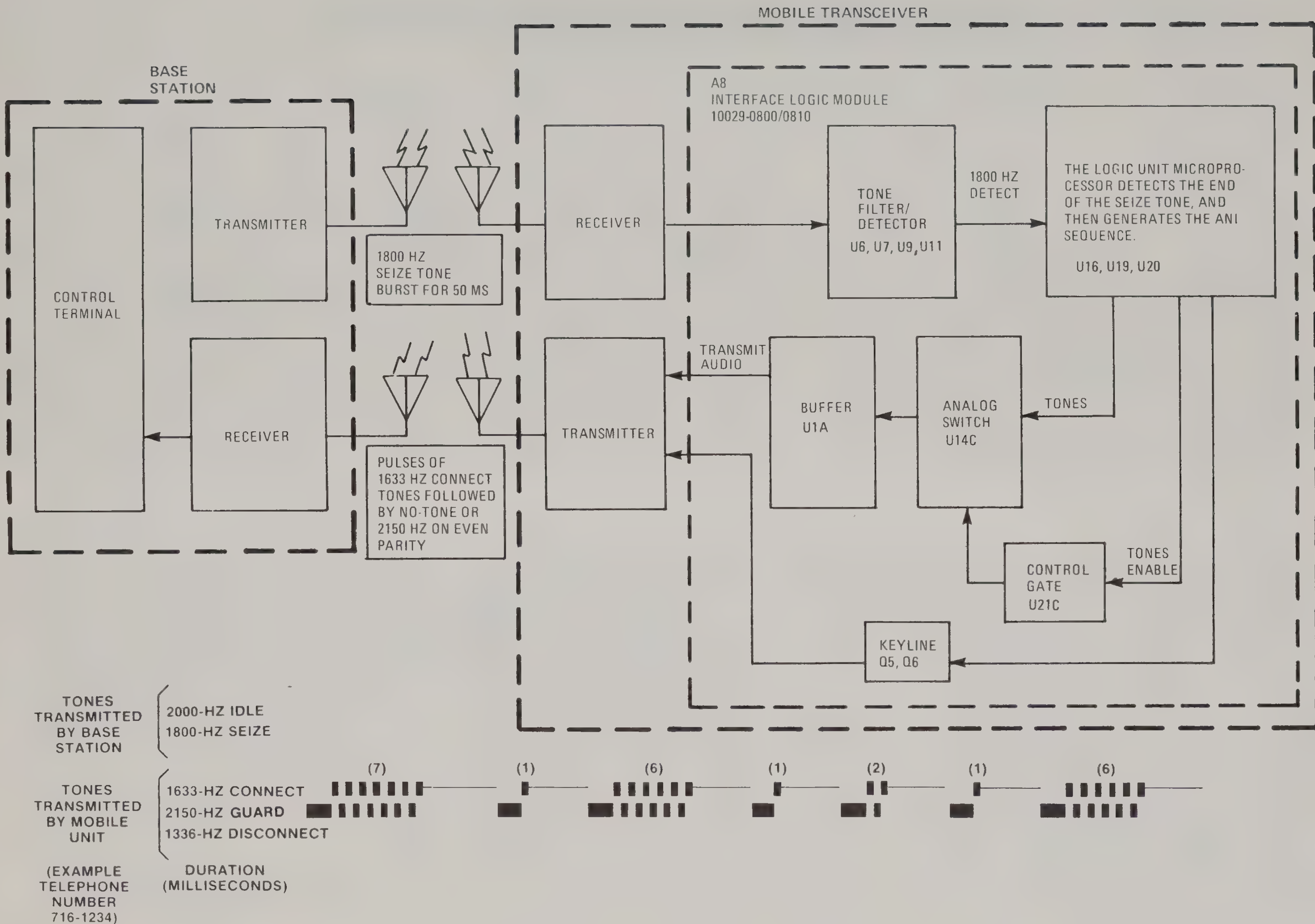


Figure 11. Functional Block Diagram, IMTS Mode, Mobile-to-Landline Call Sequence, Connect, ANI Outpulsing

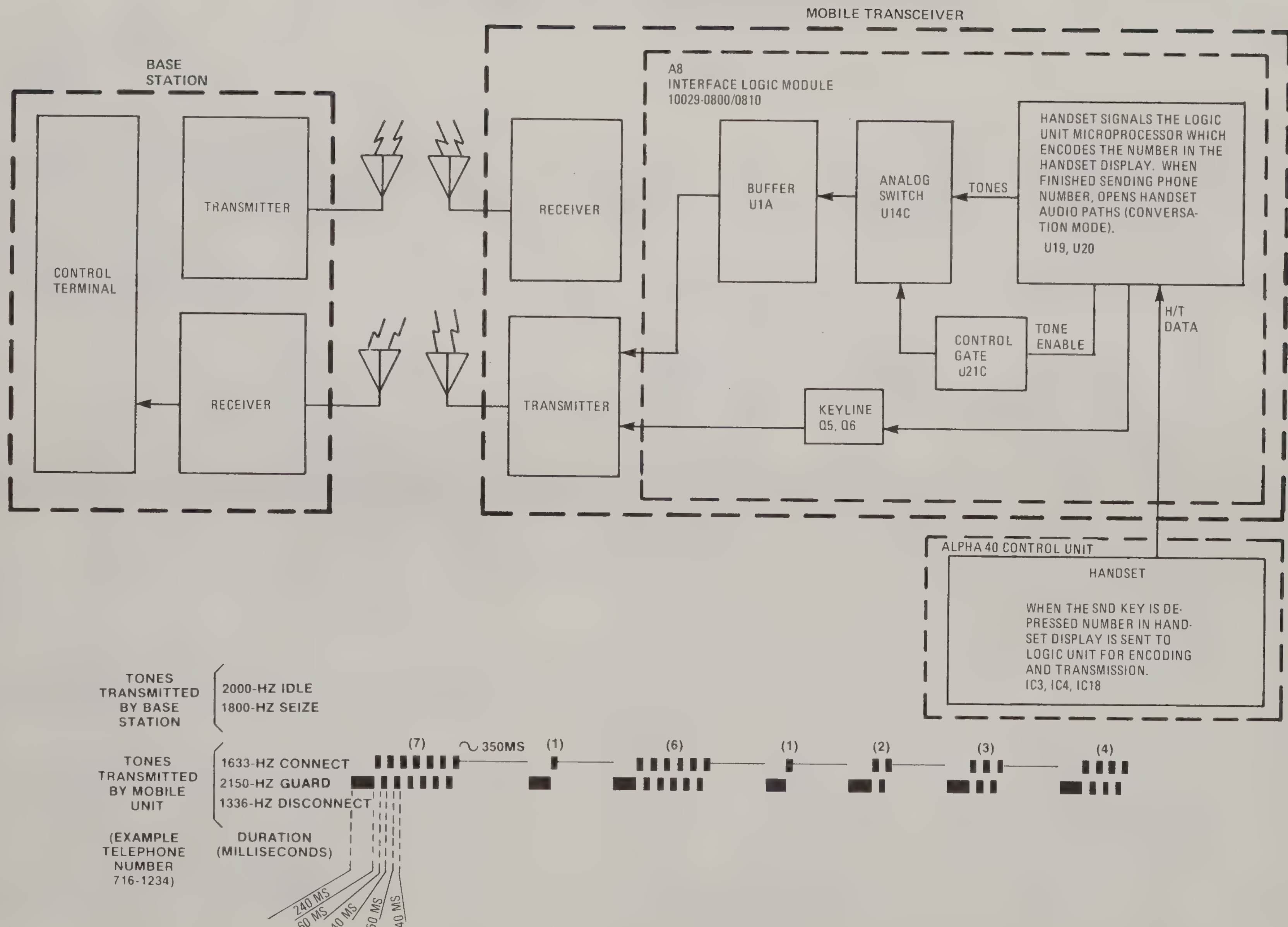


Figure 12. Functional Block Diagram, IMTS Mode, Mobile-to-Landline Call Sequence, Dialing

D . Control Unit Description

4.13 This section describes operation of the Alpha 40 Control Unit. Detailed descriptions of the programs which determine the operation of the microprocessors are outside the scope of this manual, and are not included. However, information on microprocessor data transfer has been included.

Handset

4.15 Refer to the Handset Block Diagram, figure 13 and the Handset Schematic Diagram, figure 21. Table 3 lists the Handset electrical specifications. Power at +8.5V is derived from +12V supply by means of three-terminal voltage regulator U7. This powers all the active circuits in the Handset. The nominal +4V supply, derived from voltage divider R22 and R33 across the 8.5V supply, is used to bias operational amplifiers U4A and U4B and emitter follower Q4.

4.16 The output of ceramic microphone M1 is amplified by Q1 and buffered by emitter follower Q5. The output of Q5 is sent through cables to the Interface Logic Module for amplification and shaping. Transistor Q6 is used to switch voltage on the collector of Q5. When dialing calls with Handset on-hook, acoustic feedback from the external speaker to the microphone is prevented if the supply to Q5 is removed. During this time, microprocessor U3 is programmed to produce a low level on pin 3. This low enables the PA Control and holds off Q6.

4.17 Audio from the mobile Receiver is routed through the Interface Logic Module to emitter follower Q4, which drives the earpiece. A second input to Q4 comes from U1D; which is enabled when U3-21 is low. U3-21 goes low whenever a key is depressed. This allows a nominal 1076-Hz tone from U2 to be heard in the earpiece which provides acoustic feedback during keyboard operation. U2 is a 12-stage binary counter. The 2.204 MHz input from crystal oscillator U1A, is divided by eight at U2-6, and by 2048 at U2-15. The latter produces the 1076-Hz tone. The tone is inhibited by gate U1D, when the ADV key is used in the manual mode to step through channels. This is affected by a high level on U3-1 (wire-ORed with U3-21). The keyboard feedback tone is also inhibited after dialing or after call connection in the automatic mode.

4.18 The divide-by-eight output at U2-6 produces a nominal 275 kHz signal. This is used to clock microprocessor U3, and determines its cycle time and speed of operation.

4.19 Terminations K1, K2, K4, and K8 on U3 are inputs, that are collectively called the Input bus. Lines R0 through R10 are outputs. R1, R2 and R3 constitute the Control bus. The remainder constitute the Data bus. The O Lines O0 through O6, constitute outputs used to drive the display. The condition of these outputs is determined by the fixed program and variable data stored in U3. The seven-digit, seven-segment display and keyboard are both multiplexed in time. This means that each digit or key is sampled for a short period of time at a high repetition rate.

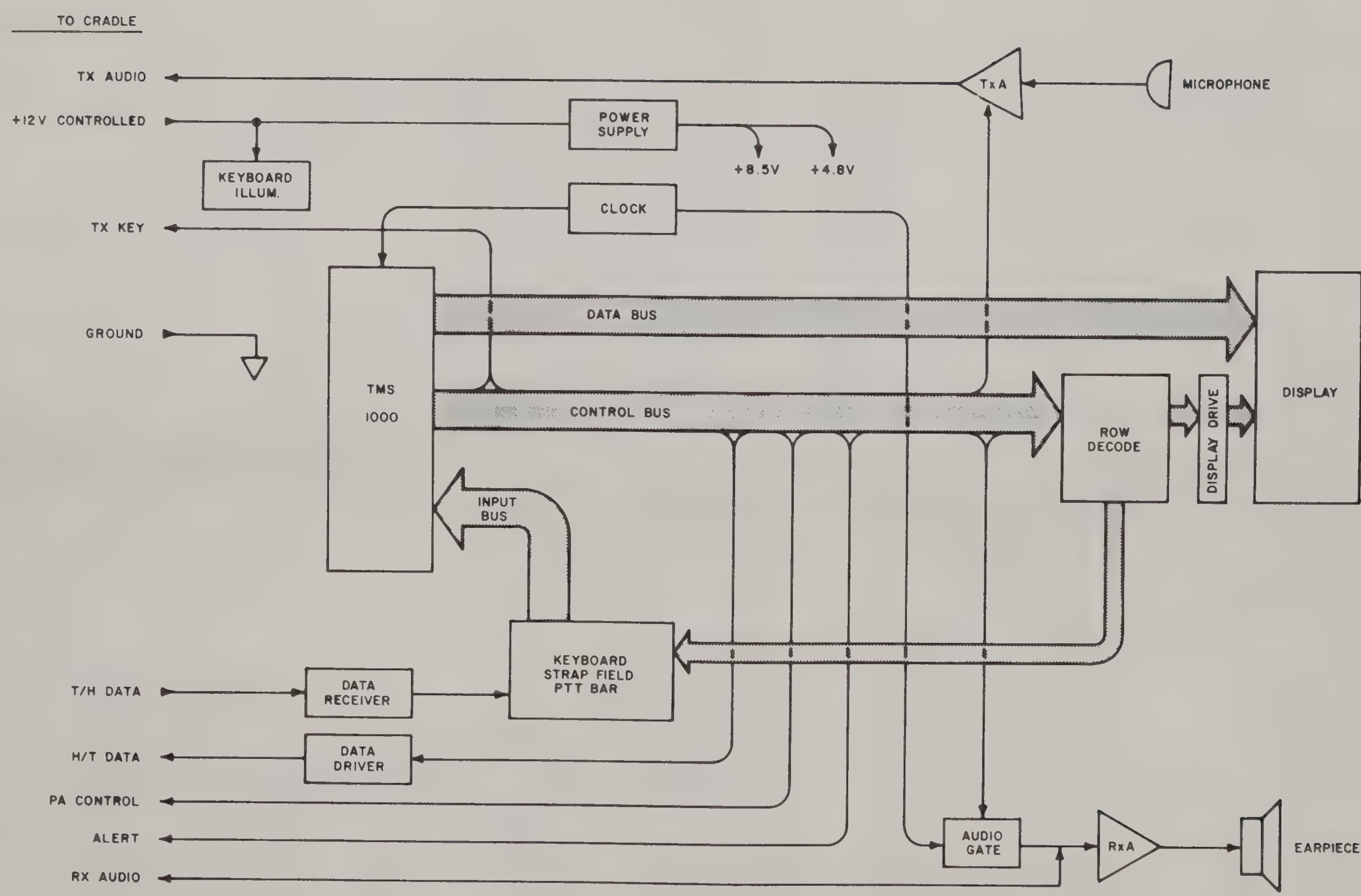


Figure 13. Functional Block Diagram, Handset Logic

4.20 R1, R2 and R3 cycle successively through binary numbers zero to seven. These inputs to U5 are decoded to produce successive high levels on outputs zero through seven. These eight lines are connected to keyboard switches in pairs. The common contacts are connected in groups to pin 6 and pin 7 of U3. Thus, if key 9 is depressed, U3-6 will go high during time slot 1, while the microprocessor recognizes and stores the input of '9.' Similarly, if pin 7 goes high during time slot 3, number '3' is recognized. The microprocessor must first 'see' an open circuit on a given time slot, before the same number can be entered again.

4.21 The decoded outputs of U5 are inverted by U6 to produce successive low levels on pins 4, 6, 8, 10, 12, 14, 16 of DS1. The seven LED segments of each digit in DS1 share a common cathode. Anodes which correspond to segments of all digits, are connected together at inputs a through g. Thus in the first time slot, DS1 pin 4 goes low, effectively grounding the cathode of the first digit. When a high level is present on inputs a through g, corresponding segments will be iiluminated. The pattern of highs on the segment inputs is determined by the number stored in the approximate register of the microprocessor. During the next time slot, pin 6 of DS1 is low and the pattern of highs on inputs a through g is determined by the number in the next register. This process is repeated until all digits have been scanned. Each digit is displayed 60 times per second. When the SEL key is first depressed, U3-28 goes high. This level is buffered by emitter follower Q2 to DS1 pin 5, which produces a decimal point in each digit position.

4.22 Serial output data from Handset to Transceiver is generated by the microprocessor, and appears at U3-2. The signal is buffered and inverted by U4A. Integrating capacitor C5 slows the rise and fall times of pulses, which minimizes the level of noise picked up by audio lines in the control cable. Data returning from the Transceiver is buffered without inversion by U4B. After inversion by U1B, it is fed to U3-8 (K8 of the Input bus). The program in U3 periodically samples K8 to check for presence of input data. The method by which Handset microprocessor and Interface Logic Module microprocessor communicate with each other is covered in section F of this tab section.

TABLE 3

Handset Electrical Interface Specifications

LEAD	PARAMETER	SPECIFICATION
+12V Controlled	Voltage	+13.8 Vdc ± 20%
	Current	350 ma. maximum (225 ma. Typical)
Tx Audio	Source Current	Less than 100 ma.
	Coupling	Dc with approx. 4.3V bias
Rx Audio	Termination Impedance	4.7K ohms
	Coupling	Capacitive—1 μF into 4.7K ohms resistor
T/H Data	Threshold	4.3 volts
	Hysteresis	180 millivolts
H/T Data	High Level	Approximately 6.7 volts
	Low Level	Approximately 2.0 volts
PA Control	On	Approximately 0 volts, open circuit
	Off	8.0 volts through 220K ohms resistor
Alert Control	On	8 volts through 4.7K ohm resistor
	Off	Approximately 0 volts, open circuit
Tx Key*	On	7.9 volts through 180K ohm resistor
	Off	Approximately 0 volts, open circuit

***NOTE:** This line is bi-directional and may be sourced from the Interface Logic Module.

4.23 When a call is received, the word CALL flashes in the display and U3-27 gives a pulsed output. This pulses a relay in the Cradle to activate an external alert signal.

4.24 When either the PTT bar on switch S1 is operated in the Manual mode, U3-5 goes high. The program then causes U3-25 to go high. This grounds the Transmitter keyline through emitter followers Q3 and Q5. In the IMTS mode, the Interface Logic Module microprocessor activates the Transmitter keyline. This happens automatically whenever a call is received or initiated. When the Party mode is selected, the Transmitter Keyline control reverts to the Handset.

4.25 Diode CR3 and capacitor C4 ensure that the execution of the program starts at the same fixed location, when power is first applied. C4 holds U3-9 at a high level until supply voltage has stablilized, CR3 discharges C4 fully when power is removed, to allow a proper reset if the supply voltage is switched rapidly.

Cradle

4.26 Refer to the Cradle schematic diagram, figure 23. Power from the vehicle battery to the Cradle circuits is controlled by switch S1 except in the alert circuit. This circuit consists of transistor Q2, relay K1, and associated components. It is powered directly from the battery through fuse F1. With switch S1 in the ON position, Q2 is prevented from turning on by zener diode CR5. In the AUX position, a high on the alert line (an incoming call or the alert line being severed) turns on Q2 which energizes K1. Jumper JMP1 is normally in position so the resulting contact closure will energize the horn relay of the vehicle through J4-14 and 16. For applications requiring normally closed contacts, such as Theft Alert Unit RF-4940-02, JMP2 is used rather than JMP1.

4.27 When switch S1 is in the OFF position, power is removed from Handset and the Interface Logic Module. The alert circuit is still enabled, but the low on the alert line is kept low by R42 in the Handset. If this line is opened by any means, the base of transistor Q2 will go high and Q2 will turn on and energize relay K1 to provide connection or open circuit between J4-14 and J4-16. Varistor R10 protects these relay contacts by limiting peak voltage applied between J4-14 and J4-16.

4.28 Voltage transients on the 12-volt line are clipped to a safe level by varistor R17. Voltage comparator U2 monitors the input voltage and turns on transistor Q3 only after the input voltage has reached the minimum operating level of 9.0 volts. When Q3 is on, power is applied directly to the Handset and to the Transceiver through transistors Q1 and Q2.

4.29 Processed audio from the Interface Logic Module is attenuated by resistor R4, the ear-piece volume control, which is preset to a suitable listening level. The audio signal is attenuated also by the network of resistors R3, R5, and R6. Potentiometer R5 is used to set the speaker volume (when dialing on-hook) or the level of the alert tone from loudspeaker LS1. When a speaker is used, LS1 is normally disconnected by removing JMP3. The presence of resistor R6 prevents setting audio level to zero, so that calls are not inadvertently missed. The audio signal from the wiper of R5 is connected to one differential input on U1, while the other grounded resistor through R1. Under these conditions, U1 operates normally with a built-in voltage gain of 50. When the PA Control line goes high, U1 is saturated and no audio signals are heard from LS1 or the speaker connected to J4-15 and -16.

4.30 Normal operation of the Control Unit requires that a signal be provided to indicate to the Interface Logic Module microprocessor whether or not the Handset is on-hook. This is done by means of transistor Q1 and LED CR3. When the Handset is off-hook, the light from CR3 causes the open-base transistor to conduct thus turning on Q1. This produces a high level at J4-6. Conversely, when the Handset is on-hook, a plastic shield blocks light from CR3, Q1 turns off and J4-6 goes low. These conditions are noted only when J4-16 has a load of approximately 47K ohm (R76).

4.31 Indicator DSI is illuminated whenever the Transmitter is keyed. This happens when the Tx Keyline goes high during receipt or initiation of a call in IMTS, or when the PTT bar or S1 is operated in Manual mode.

E. Interface Logic Module (0800/0810) Description

4.32 Refer to the Interface Logic Module schematic diagram, figure 25 and the Interface Logic Module block diagram figure 1. The most important single item is microprocessor U19. All of the other logic elements are associated with the inputs or outputs of the microprocessor. The program which directs operation of the microprocessor is contained within Read-Only Memory (ROM) U20. This has a maximum storage capacity of 2048 8-bit binary numbers. The program is fixed by the manufacturer. Its design directs the microprocessor to perform the many functions of the Control Unit. These include: generation of tones and timing intervals necessary in the IMTS system, initiation of calls from the mobile Transceiver, decoding of incoming calls, and providing communications with the Handset.

Tone Generation

4.33 The tones, of appropriate frequency and duration, are generated at port P27 of U19 (pin 38). The program determines the number of machine cycles for which P27 remains high. In this case one machine cycle is equal to 15 periods of the clock frequency, which is determined by 5.185 MHz crystal Y1. A pulse output at the machine-cycle frequency appears at U19-11, the Address Latch Enable. When P27 is held high for the correct number of machine cycles, it is then forced low for an equal number of cycles. The total duration is equal to one period of the desired tone. This routine is repeated until the desired number of tone cycles has been produced. In a similar manner the duration between tones is determined by programming the microprocessor to execute repeatedly a sequence of instructions for a prescribed number of times. The accuracy of the tone frequencies and durations is determined by the program and the frequency of Y1. The method of tone generation means that the tone period must be an integral multiple of the ALE period—approximately 2.9 microseconds.

Data Transfers

4.34 The Data Bus lines, DB0 through DB7, and ports P20 through P23 are bi-directional input/output lines. P23 is used, however, only as an input port. The other eleven lines are connected to ROM U20. The Data Bus lines are also connected to the data inputs of U12 and U13, 4-bit D-type flip-flops. When ALE goes low, the high level on pin 9 of U12 and U13 latches the input data, which then appears on the corresponding Q outputs. They in turn, are connected to A0 through A7 of U20. These eight address inputs, together with the A8, A9, and A1 inputs from the microprocessor, are decoded to select 1 of 2^{11} (2048) addresses. PSEN (Program Store Enable) of the microprocessor then goes low, and enables the 8-bits of data at the selected address to appear on the Data Bus. The Bus reverts to the input mode and the microprocessor accepts the 8-bit word as an instruction.

4.35 In a similar manner, data is read from Random Access Memory (RAM) U15, by the address on A0 through A7 lines. These eight lines select 1 of 2^8 (256) addresses. Now PSEN remains high and the RD line of the microprocessor goes low, transferring the 4-bit word from the RAM to the Data Bus lines zero through three. The RAM differs from the ROM in that data may also be written into it. The procedure is the same as for reading except that RD and PSEN are high and WR goes low during the time when the data to be written is present on the Data Bus.

4.36 Code plug U16 stores the user telephone number (ANI) and details on the options provided in that particular Control Unit. The Programmable Read-Only Memory (PROM) is programmed based on information supplied by the user at the time of purchase. Data is read by first addressing the PROM to select one of thirty two 4-bit words. Power is applied by a low on P26 of the microprocessor, which turns on transistor Q7. A low on the RD line of the microprocessor then enables the PROM, and the selected data appears on the Data Bus lines 4 through 7. The sequence described also reads data from the same address in the RAM, this data appearing on the Data Bus lines 0 through 3. The program rejects data on these four lines when PROM is being read.

Tone Detection

4.37 Signaling tones, transmitted by the Base Station, are received by the Receiver and appear at J3-7. The audio signals are amplified by U10A, with a voltage gain of three. They are then fed to two tone detectors A and B. These differ only in that they are tuned to different frequencies.

4.38 The audio signal is squared and clipped by limiter U2A. The signal at U2A-1 is 1.4 volts peak-to-peak, and ensures that the bandwidth of the filter is independent of the audio level from the Receiver. The filter consists of operational amplifiers U2B, U5A and U7A,

together with associated components. The feedback path is completed through analog switch U11A of U11B, depending on the system in use. The switches are controlled by the P24 output of the microprocessor. This 5V level is buffered, and converted to two 10V levels of opposite phase by U17B and U17D. In the 0800, the filter is tuned by potentiometer R24 to 1500 Hz, and by potentiometer R26 to 2000 Hz. The B tone filter is tuned to 600 Hz by potentiometer R25, and to 1800 Hz by potentiometer R27. In the 0810, the A tone filter is tuned to 2805 Hz by R24, and to 2000 Hz by R26. The B tone filter is tuned to 1800 Hz by R27. (R25 is not used in 0810.)

4.39 When a tone of the correct frequency is applied to the filter there is corresponding tone at the output U5A-1. In the absence of tones, capactor C16 is charged to about +6V. This holds the output of U5B at a high level. A tone at the output of U5A is converted to a dc level across C16, and voltage doubler circuit C14, CR7, CR9 and C16. The voltage across C16 drops below the +5V threshold on U5B-6, and the output of U5B switches to a low level. This low level is inverted by U18D to produce a high level at the INT input of the microprocessor, recognized as an A tone input. Similarly a B tone input is recognized by a high level at P23. The outputs of the tone filters and detectors are available for test purposes at J4.

Serial Data

4.40 Communications between the microprocessors in the Interface Logic Module and the Handset take place by way of T0 and P25. If an incoming call is decoded, the Interface Logic Module microprocessor must transmit serial data to the Handset microprocessor to cause it to display the word CALL. This is initiated by a high level on P25 of U19 (pin 36). The level is inverted by U18F, buffered and inverted again by U8A. Integrating capacitor C30 is used to decrease the rise and fall times, thus minimizing noise pick-up on the audio lines in the control cable. Upon receipt of the signal from the Interface Logic Module, the Handset acknowledges by returning a low level to J1-4. This is inverted in U8B and U18C to produce a low level at U19-1, and T0 input of the microprocessor. The microprocessor then transmits 4-bits of data. Each subsequent group of four data bits requires the initiation and acknowledge sequence before that group can be transmitted. The method by which the microprocessors communicate with each other is covered in detail in section F of this tab section.

Channel Selection

4.41 The channel selected at the Control Unit appears in binary form at microprocessor ports P10 through P14, which is then routed through J2 pins 3 through 7, to synthesizer PROM A9U3. P10 (J2-3) is the A-bit (LSB). These five lines yield $2^5 = 32$ possible channels that the microprocessor can address. The channels scanned may be further limited by programming in code plug U16 or from the Handset programmable fields.

4.42 Two other channel address lines are available on the Interface Logic Board to provide control of the full 128 channels. J2-8 connects to the F-bit address line of PROM A9U3 and controls selection of VHF or UHF channel information. The line is pulled high by resistor R98. Jumper JMP3 on the Master Synthesizer Logic Module A9 is used to pull the line down for UHF channels. With the jumper out the line will be high, and the VHF channel information will be available to the Synthesizer LSI. J2-9 connects to the G-bit address line of PROM A9U3 and controls selection of RCC or Telco channel information. The line is pulled high by resistor R97. Jumper JMP2 is installed on 0810 boards to pull the line down for RCC channels and left out on 0800 boards to let the line stay high for Telco channels. See table 1#2, chapter 1, for more information.

Analog Switching

4.43 In the normal course of operation, it is necessary to switch audio signals and tones being received and transmitted by the Transceiver. This switching is performed by solid state analog switches which are controlled by the microprocessor. These switches are U14A, B, C and D and are controlled by a logic level at pins 13, 5, 6 and 12. When the control line is high, the switch is closed (low resistance).

4.44 In the IMTS mode of operation, tones produced by the microprocessor, for dialing purposes, are inhibited from reaching the earpiece. A high level of P16 is inverted by U21B to produce a low at U14D-12, holding the switch open. Thus the tones produced at P27 cannot reach the input of U1B, which feeds the received audio to the Handset earpiece. At the same time P15 is low. This level is inverted by U21C to produce a high level at U14C-6, closing the switch and allowing the tones to pass through audio buffer amplifier U1A to the Transmitter audio input. Combinations of the logic levels on P15 and P16 control the four analog switches.

Other Functions

4.45 In order to provide the appropriate control signals, the microprocessor must be supplied with Handset status. When it is on-hook a low logic level is provided by the Handset and appears at J1-6. This is inverted by U10B, and transistor Q8 is turned on. The low level from the collector of Q8 is an on-hook indication of the microprocessor.

4.46 In the IMTS mode of operation the Transmitter keying is under the control of the Interface Logic Module. When P17 goes low, transistor Q6 turns on and supplies base current to transistor Q5, which saturates and effectively grounds the Transmitter keyline (J2-15). Similarly in the Manual mode of operation a high level is present on J1-3 when the PTT bar is operated. This turns on Q5, grounding the Transmitter keyline and turning on the Transmitter. Tx TEST switch S1 is enabled by Q10, which is turned on by a low from U21D-11. U21D-11 is low only in the conversation mode when the Handset audio is enabled and channel scanning is inhibited. Thus, switch S1 will not key the Transmitter when the channel lines are being scanned.

4.47 13.6Vdc from the vehicle battery through the Transceiver input filter supplies +13.6Vdc to J1-15. The Interface Logic Module and low level stages of the Transceiver are protected by fuse F1. The filtered +13.6V line supplies a nominal +5V dc to RAM U15 through regulator circuit resistor R63, diode CR13, and diode CR12. This enables the RAM to preserve data stored in it when power is removed from the system by setting the OFF/AUX/ON switch on the Cradle to the OFF position. In normal operation, power is supplied from the +5V regulated line through diode CR4. Capacitor C28 stores enough power to preserve RAM data for a few hours when power is completely removed from the Transceiver.

4.48 When the Transceiver is turned on at the Cradle, the power control line, through 8J1-1 supplies +13.6 Vdc through resistor R7 and transistor Q2 turns on. The resulting base current to transceiver Q1 turns it on, activating the controlled + battery line; +5Vdc regulators U22 and U23, and +10Vdc regulator, transistor Q3, transistor Q4 and diode CR2.

4.49 Voltage sensor U24 provides enabling signals to the RAM and microprocessor when the nominal +12V supply is higher than +10V. This prevents malfunctions which otherwise might occur when a vehicle is started in very cold weather and the battery voltage drops to a low level. The voltage at the threshold input (U24-3) is compared with an internal 1.15 volt reference. When the voltage is less than the reference, output pin 4 is grounded through a transistor. This low level disables the RAM at the CE2 input and holds the microprocessor in the reset condition. When the supply voltage exceeds the 10V level, the threshold input exceeds the reference, and the output goes high. The hysteresis output from pin 2 goes high at this time which speeds up the switching action. The high level from U24-4 enables the RAM and the microprocessor to operate normallv.

Code Plug and Ram

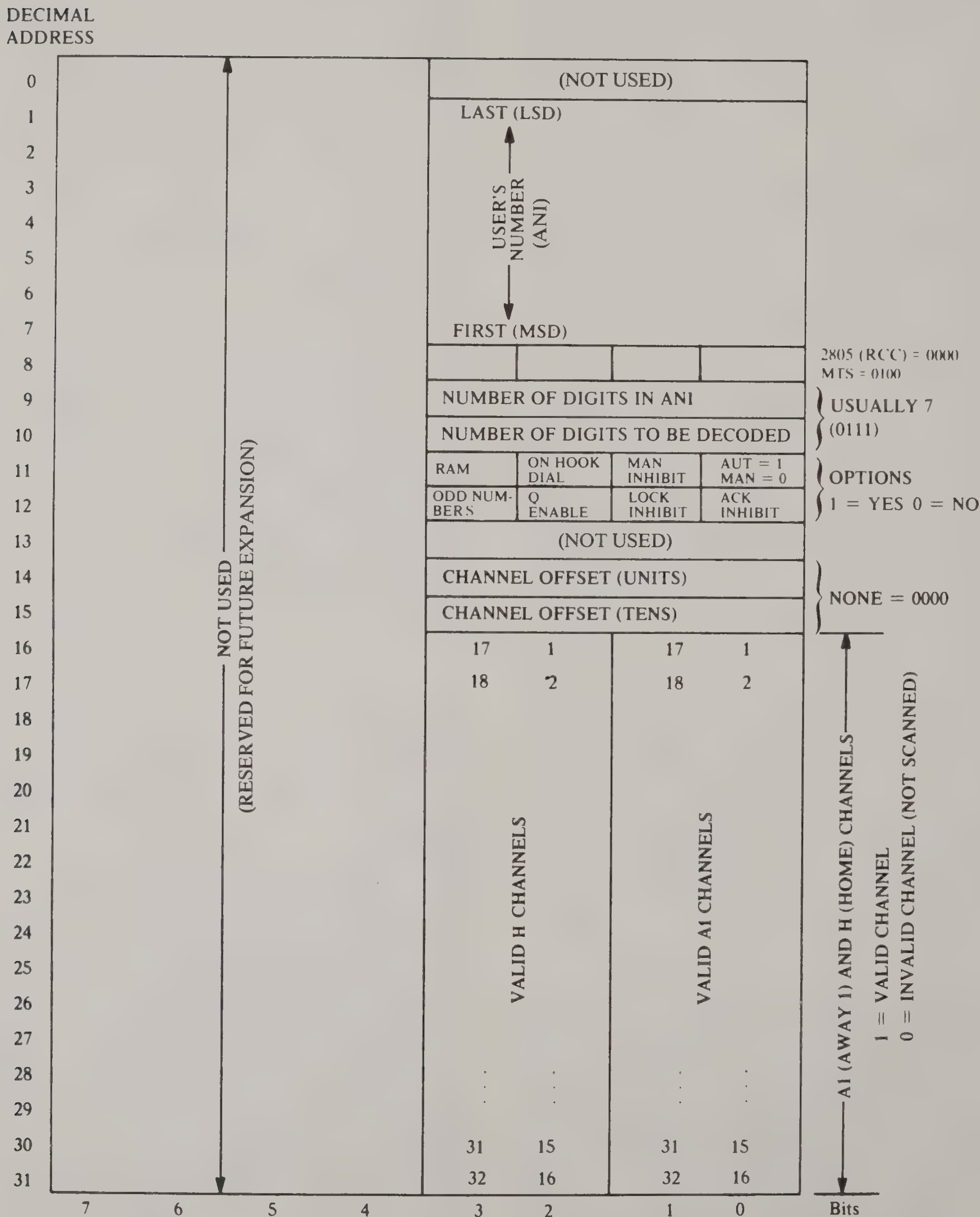
4.50 Code plug U16 is a 256 bit (32 x 8) PROM which is programmed to store: the user phone number (ANI), valid home channels, valid away-1 channels, number of digits in the ANI, number of digits to be decoded, and offset of the channel numbers. Also contained is information on options such as: automatic queuing, lock inhibit, acknowledge inhibit, on-hook dialing, power-up mode, RAM storage of ten numbers, and automatic and/or manual modes of operation. The code plug stores all of this information in the form of ones and zeros.

4.51 Table 4 shows the PROM memory locations and indicates which locations are dedicated to the functions mentioned. Each of these functions and options is described in detail following a brief discussion on how the user telephone number can be written in the form of ones and zeros.

4.52 Table 5 shows the decimal numbers and their binary representation. Note that each decimal number has 4-bit binary representation and the code plug is set up so that for each of the seven-digits in the phone number there is a 4-bit location reserved. Also note that the first 4-bits or the first four most significant bits of each word address location is not used. Basically for the options, a ''1'' means yes and a ''0'' means no. For example, in table 4, if you look at word address ''12,'' and see 0100, the ''1'' corresponds to the block labeled Q for automatic queuing. This would indicate yes, the automatic queuing functions is available to the unit containing that code plug. It would also indicate no odd numbers which is an offset that changes the channel numbers to be displayed to just odd numbers, no lock inhibit and

TABLE 4

Programming Memory Partitioning of the U16 Code Plug PROM



no acknowledge inhibit. For the Away and Home channels, each channel number has a location in the code plug. A "1" in that location makes that channel available and a "0" makes it unavailable to Handset access.

4.53 Word addresses 14 and 15, will offset the channel number display by 1, 2, 20, 30, etc. 0000 gives no offset and the channels are displayed in their basic form 1, 2, 3, etc. With a binary 2 (0010) in location 15, the channels are displayed as 21, 22, 23, etc. Note that this offset controls only the displayed channel number and has no effect on channel information sent to Master Synthesizer Logic Module A9. The binary equivalent of the decimal number (according to table 5) of the digits to be decoded and the number of digits in the ANI, are recorded in the code plug at word addresses 9 and 10. Word address 8 is always 0100 in the 0800 Interface Logic Module (denotes MTS signaling) and is always 0000 in the 0810 Interface Logic Module (denotes 2805 RCC signaling).

Features Controlled by Code Plug

4.54 Q (Automatic Queuing): When placing a call in the IMTS mode and a channel busy occurs, the user can press SEL, Q on the keyboard to instruct the microprocessor to continue to scan for an Idle tone. When a channel becomes idle, the microprocessor will automatically seize that channel and obtain Dial tone. Queuing is enabled by a 1 in address 12 bit 2.

4.55 Electronic Lock Inhibit: Normally, when the Control Unit is turned on (if previously locked) the word ACCESS will be displayed on the Handset. A three digit code must be entered and the SND key pressed to release the electronic lock which permits use of the mobile telephone. Once unlocked the Control Unit will remain unlocked until SEL, LCK is pressed. Lock inhibit is enabled by programming a 1 in address 12 bit 1. (When Access is displayed the Control Unit can still receive calls, but none can be initiated.)

4.56 ACK Inhibit: When using this option and assuming that the Control Unit is turned on, incoming calls will be decoded but receipt of the call will not be acknowledged to the Base Station terminal. Therefore, the Control Unit will not ring. However, since the calls will be decoded, the word CALL will appear on the display. This option is enabled by programming a 1 in address 12, bit 0 but will not be functional if the Lock Inhibit option is programmed.

4.57 RAM (Random Access Memory): This is a user digital memory that performs four functions. (a) Ten telephone numbers having up to 14 digits each can be stored. By two keystrokes any one of the 10 numbers can be recalled and displayed ready for transmission. Since the display shows only seven digits at one time, the ADV (Advance) button must be pressed to display the remaining digits. However, all digits of the recalled number will be transmitted regardless of the display in view. (b) When power to the Control Unit is removed, the RAM will store the last mode of operation. When turned on again and if access is not inhibited, operation will resume in that same mode. (c) The RAM retains information concerning programmed away-2 channels when the Control Unit is turned off. (d) Lock Mode is also stored, e.g., if unit is unlocked and then turned off, it will come up in the unlocked mode when power is turned on. All RAM operations are enabled if a 1 is programmed in address 11, bit 3 of the code plug.

TABLE 5

Decimal To Binary Conversion

DECIMAL	BINARY
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001
10	1010

4.58 On-Hook Dial: This feature permits the user to initiate a call without removing the Handset from the Cradle. When answering, the called party answer will be heard over an external loudspeaker. The user will not need to pick up the Handset unless a conversation is to take place. This may be helpful when retrieving recorded

messages or on any call that does not require a response. An external loudspeaker accompanies this feature. On-hook dialing is enabled by programming a 1 in address 11, bit 2 of the code plug.

4.59 MAN INH (Manual Inhibit): Use of the manual mode may be inhibited by programming a 1 in address 11, bit 1.

4.60 AUT/MAN: In absence of the RAM, this feature is required and will cause the Control Unit to be functional in either the Automatic or Manual mode when powered up. Address 11, bit 0 must be 1 for AUT and 0 for MAN.

F. Microprocessor Data Transmission

4.61 This section outlines the method of data transfer between two microprocessors utilizing a serial data communication link.

4.62 The two microprocessors utilize separate clocks running at different frequencies. The communication must therefore be considered completely asynchronous, governed totally by the timing and synchronization techniques.

4.63 The Handset microprocessor runs at a clock rate of 275.5 kHz. Each microprocessor instruction requires six clock cycles for execution. Therefore, one instruction is equivalent to 21.78 usec.

4.64 Due to cross talk and setting time, the maximum transmission speed for serial communication is 1000 bits per second. The actual transmission speed is 751.8 bits per second.

4.65 The TMS-1000 Handset microprocessor contains an internal RAM organized to accommodate 64, 4-bit words and an accumulator that is 4 bits wide. Therefore, data is transferred in 4-bit words.

4.66 Single and multiword transmissions are accommodated by the transmission of a synchronizing pulse to mark the beginning of each word transmitted.

Multiplexing Definitions

4.67 Transmission Request (TREQ): The device wishing to initiate a transmission places a logic 1 on its transmit port to alert the receiving device to prepare to receive data.

4.68 Request Acknowledge (RQAK): Upon receipt of a TREQ, the receiving device will place a logic 1 on its transmit port. This provides the synchronizing signal to the Transmitter and data transmission begins. The RQAK will remain a logic 1 until the Receiver has received 4 bits of data, where upon it will revert to a logic zero.

4.69 Single Word Transmission (Figure 14): The originating device place TREQ on its transmit port. The receiving device responds with an RQAK, which begins the transmission. The bits are then transmitted from Most Significant Bit (MSB) to Least Significant Bit (LSB) with each bit stable for approximately 1.33 millisecond. The transmitting device must check for the presence of RQAK prior to sending each bit. Should RQAK drop before an entire word is sent, the transmitting unit will be returned to the low condition. This eliminates simultaneous transmission possibilities. The end of a transmission is established when TREQ does not reappear for a minimum of 1.7 msec.

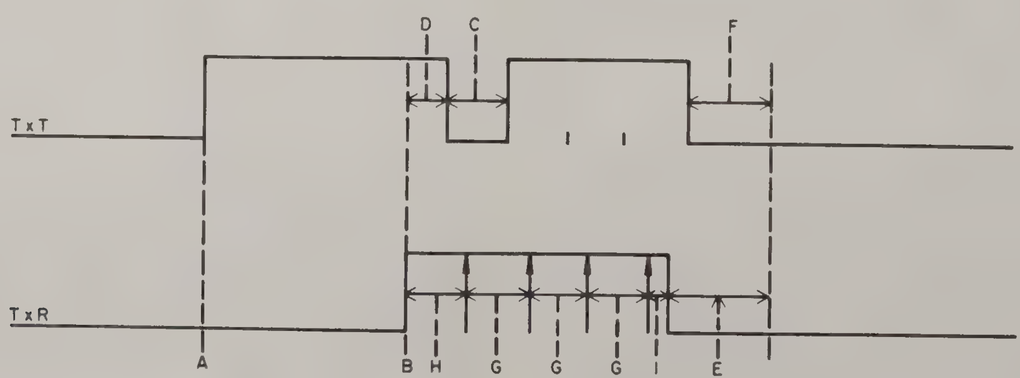


Figure 14. Successful Single Word Transmission

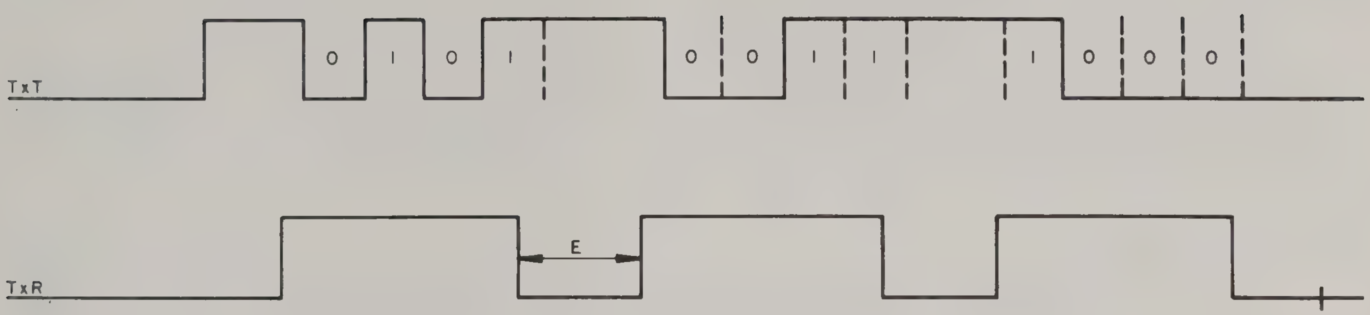
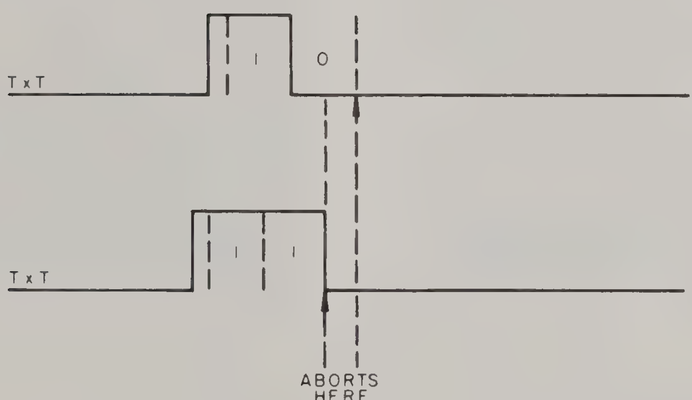


Figure 15. Successful Multiple Word Transmission



NOTE: *All data transmission is formatted with most significant bit (MSB) sent first and least significant bit (LSB) sent last.*

The checksum is the 2's complement of the sum of all previous data.

Example: Transmit 1 2 3 + CK — CK = 2's comp of 6

CK = 1010 = A_{16}

Figure 16. Simultaneous Transmission

4.70 Multiple Word Transmission (Figure 15): RQAK must be low for a minimum of 1.72 milliseconds before acknowledging another TREQ. This provides the synchronizing pulse to the transmission of each successive data word.

4.71 Simultaneous Transmission (Figure 16): Precluded from the first word transmitted is the all-ones data word (F16) except for retransmit request sent following a checksum error. Thus, should simultaneous TREQ occur, the first time RQAK is detected as missing transmission will abort.

Multiplex Specifications

NOTE

Letters refer to the accompanying diagrams. (Figures 14, 15, and 16).

(a) *The Transmit Request (TREQ) is a logic one on the transmit data port of the transmitting device. (T x T)*

(b) *The Transmit Request Acknowledge (RQAK) is a logic one on the transmit data port of the receiving data (T x R)*

(c) *Bit stable time is 1.328 msec. nominal (61 TMS-1000 instructions)*
Minimum 1.284 msec. (59 instructions)
Maximum 1.372 msec. (63 instructions)

(d) *Allowable differential between receipt of RQAK and first bit sent is:*
0.414 msec. maximum (19 instructions)
0.348 msec. minimum (16 instructions)
Allowable multiple word transmission is 15 words + checksum.

(e) Minimum time for drop of RQAK between words is 1.72 msec.

(f) Minimum time for drop of TREQ to denote end of transmission is 1.7 msec.

(g) Read interval is 1.306 msec. nominal (60 instructions ± 1 instruction).

(h) Interval from RQAK to first read window is 1.110 msec. (51 instructions ± 1 instruction). Read sample time = 1 instruction cycle (21.8 usec.)

(i) Time required for drop of RQAK following final read window is: 0.326 msec. maximum (15 instructions).

5. MAINTENANCE

A. General

5.01 This section covers the procedures to be followed to maintain the Interface Logic Module and the associated Control Unit parts in full operating condition. Component location diagrams and schematic diagrams are provided in Section 6 and 7 for a more detailed examination and troubleshooting of the circuitry.

B. Preventive Maintenance

5.02 A complete inspection of the Interface Logic Module and the associated Control Units should be performed every six months and more frequently under abnormally severe environmental conditions or usage. Refer to Chapter 4, Maintenance, for specific items to be inspected and the conditions to be observed.

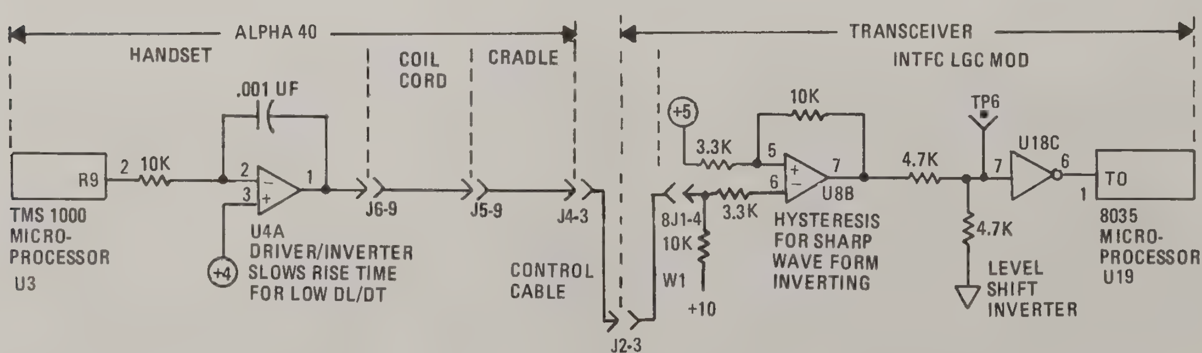


Figure 17. Handset-to-Trunk (H/T) Data Line Simplified Diagram

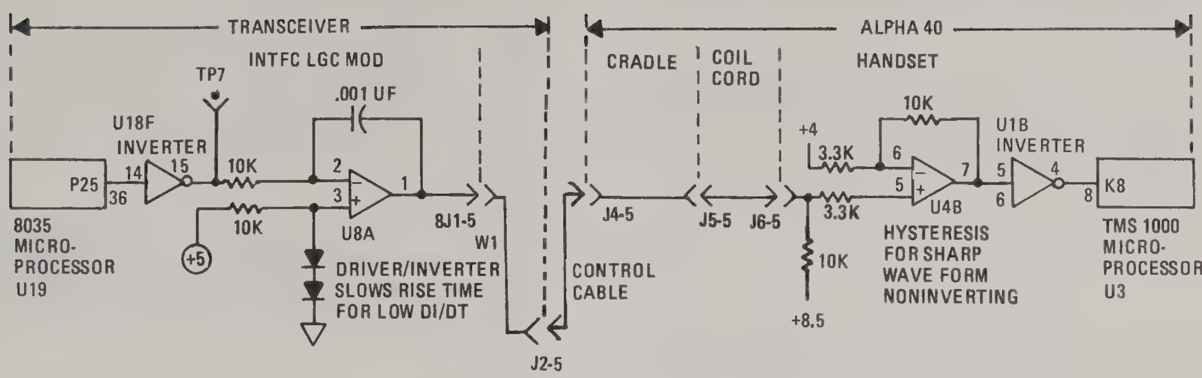


Figure 18. Trunk-to-Handset (T/H) Data Line Simplified Diagram

C. Routine Maintenance

5.03 The inherent life of the components used in the Interface Logic Module and the associated Control Units will provide many years of failure free operation if reasonable care is used. Refer to Chapter 4, Maintenance, for the routine checks that should be made to ensure reliable operation of the equipment.

5.04 The following is a procedure for the alignment of the tone filters on the Interface Logic Module. The adjustments indicated by the alignment procedure are made at the factory prior to shipment. Normally, readjustment of these controls should not be necessary unless there are component failures or readjustment becomes necessary for some other specific reason.

D. Interface Logic Module Tone Filter Alignment Procedure IMTS/MTS-0800 (ALPHA 2244)

(a) Ensure that Control Unit is connected to Transceiver.

NOTE

Remove receive audio from IF/Audio Module A3 by disconnecting plug W3P6 from jack J3.

(b) Connect an HP model 204C audio generator, or its equivalent, to the Rcv Audio In test point J4-18.

(c) On Cradle, place OFF/AUX/ON switch to ON.

(d) Place Control Unit in Automatic mode (AUT) (AA1, AA2, or AH on Handset display).

(e) Connect one channel of a Textronix Oscilloscope Model 453, or its equivalent, to Rcv Audio test point J4-6 for use as a trigger source and connect the other channel to Tone A test point J4-9

(f) Set audio generator for 2000 ± 1 Hz and adjust level to 0.15 Vrms. Adjust R26 for 180° phase shift as noted at J4-9. The signal should be at peak amplitude.

(g) Place Control Unit in Manual mode (MAN) (A1, A2, or H on the Handset display).

(h) Set audio generator for 1500 ± 1 Hz and adjust R24 for 180° phase shift at J4-9 with maximum amplitude. Input level same as step f.

(i) Move oscilloscope probe from J4-9 to Tone B test point J4-11.

(j) Set audio generator to 600 ± 1 Hz with a 0.15 Vrms input level. Adjust 600 Hz ADJUST control R25 for 180° phase shift as noted at J4-11 with maximum amplitude.

(k) Place unit in Automatic mode (AUT).

(l) Set audio generator for 1800 ± 1 Hz and a 0.15 Vrms input level. Adjust R27 for 180° phase shift and maximum amplitude at J4-11.

(m) Place OFF/AUX/ON switch to OFF. Disconnect test equipment and reconnect plug W3P6 to J3.

E. Interface Logic Module Tone Filter Alignment Procedure IMTS/2805 0810 (ALPHA 2247)

(a) Proceed as in IMTS alignment (5.04, D, (a) through (g).

(b) Set audio generator for 2805 ±1 Hz @ 0.15 Vrms, and adjust R24 for 180° phase shift at J4-9 with maximum amplitude.

(c) Move oscilloscope probe from J4-9 to TONE B test point J4-11.

(d) Place unit in automatic mode (AUT).

(e) Set audio generator for 1800 ±1 Hz @ 0.15 Vrms input level. Adjust R27 for 180° phase shift and maximum amplitude at J4-11.

(f) Reconnect W3P6 to J3. This completes procedure.

5.05 See tone filter alignment procedure in Chapter 4, Maintenance, for more detail and for an alternate method of alignment using the internally generated tones.

F. Troubleshooting Procedures

5.06 Refer to Chapter 4, Maintenance, for detailed troubleshooting information and standard repair practices.

Serial Data Paths

5.07 Handset-to-Trunk and Trunk-to-Handset (H/T and T/H respectively) data circuits must be operating properly to transfer dial and control information between the Handset/Cradle and the Interface Logic Module. The circuitry generally operates in a saturated high or low condition.

5.08 Figures 17 and 18 are simplified diagrams of the Handset-to-Trunk and the Trunk-to-Handset data circuits.

6. PARTS LIST

6.01 This section provides the component location information and the parts list necessary to support the maintenance of the Handset, the Cradle, and the Interface Logic Module.

6.02 When ordering parts, provide model number, serial number (on Cradle), approximate date of purchase, assembly number and designator, description and part number from the parts list.

6.03 Table 6 gives the parts list information for the Handset. Figure 20 shows the component location information for the Handset.

6.04 Table 7 gives the parts list information for the Cradle. Figure 22 shows the component location information for the Cradle.

6.05 Table 8 gives the parts list information for the Interface Logic Module. Figure 24 shows the component location information for the Interface Logic Module.

7. SCHEMATIC DIAGRAMS

7.01 Schematic diagrams are provided for each of the three assemblies described in this tab section.

7.02 Figure 21 is the schematic diagram for the Handset. Figure 23 is the schematic diagram for the Cradle. Figure 25 is the schematic diagram for the Interface Logic Module.

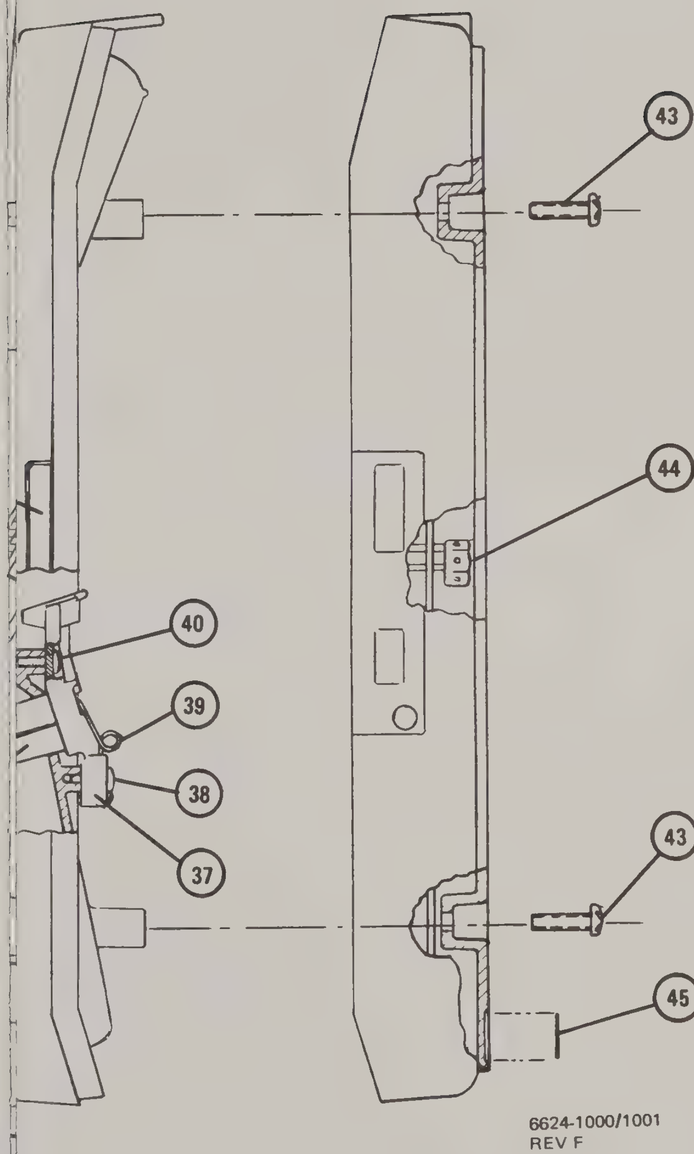


Figure 19. Handset and Cradle Assembly Diagram

(m) Place OFF/AUX/ON switch to OFF. Disconnect test equipment and reconnect plug W3P6 to J3.

E. Interface Logic Module Tone Filter Alignment Procedure IMTS/2805 0810 (ALPHA 2247)

(a) Proceed as in IMTS alignment (5.04, D, (a) through (g).

(b) Set audio generator for 2805 ±1 Hz @ 0.15 Vrms, and adjust R24 for 180° phase shift at J4-9 with maximum amplitude.

(c) Move oscilloscope probe from J4-9 to TONE B test point J4-11.

(d) Place unit in automatic mode (AUT).

(e) Set audio generator for 1800 ±1 Hz @ 0.15 Vrms input level. Adjust R27 for 180° phase shift and maximum amplitude at J4-11.

(f) Reconnect W3P6 to J3. This completes procedure.

5.05 See tone filter alignment procedure in Chapter 4, Maintenance, for more detail and for an alternate method of alignment using the internally generated tones.

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7. SCHEMATIC DIAGRAMS

7.01 Schematic diagrams are provided for each of the three assemblies described in this tab section.

7.02 Figure 21 is the schematic diagram for the Handset. Figure 23 is the schematic diagram for the Cradle. Figure 25 is the schematic diagram for the Interface Logic Module.

Handset and Cradle Assembly Hardware

Item No.	Description	RF Part No.
1.	Handset Housing, White	6624-1061
	Handset Housing, Black	6624-1060
2.	Earpiece, Speaker	A-0084
3.	Not Used	
4.	Foil, Reflective	6624-1107
5.	Screw, Tapping No. 4x1/2	MS51861-15C
6.	Clamp, Keyboard	6624-1103
7.	Pushbutton, Keyboard	6624-1102
8.	Light Distribution Panel	6624-1142
9.	Shield/Insulator Assembly	6624-1147
10.	Handset PWB Assembly	6624-1120
11.	Coil Cord Assembly	6624-1300
12.	Screw, Tapping, No. 4x5/16	MS51861-13C
13.	Foam Pad, Mouthpiece	6624-1148
14.	Foam Pad, Middle	6624-1149
15.	''O'' Ring	E45-0001-000
16.	Screw No. 4-40 x 3/8	H-0211
17.	Telephone Number Label	6624-1145
18.	Display Window	6624-1205
19.	Washer, Flat	H-0281
20.	Foam Pad, Earpiece	6624-1204
21.	Keyboard Overlay (old)	6624-1104
	Keyboard Overlay (new)	6624-1404-1
	Keyboard Overlay (Ohio Bell)	6624-1404-2
	Keyboard Overlay (PNB)	6624-1404-3
22.	PTT Spring	Z20-0003-001
23.	Screw, No. 4x5/16	MS51861-13C
24.	PTT Retainer	6624-1203
25.	PTT Pushbutton	6624-1202
26.	Screw No. 4x1/2	MS51861-15C
27.	Cradle PWB Assembly	6624-2220
28.	Screw, No. 4x1/2	MS51861-15C
29.	Washer, Flat No. 4	H-0281
30.	Clamp, Cable (W2)	MP-0233
31.	Control Cable Assembly (W2)	10029-0098
32.	Coil Cord Assembly (W3)	6624-1300
33.	Clamp, Cable (W3)	MP-0230
34.	Latch	6624-2105
35.	Cushion/Baffle	6624-1206
36.	Label, Stored Numbers	6624-2102
37.	Spring Retainer	6624-2107
38.	Screw, No. 4x5/16	MS51861-13C
39.	Spring, Pushrod	6624-2104
40.	Screw, No. 4x5/16	MS51861-13C
41.	Label, OFF/AUX/ON	6624-2103
42.	Cradle Housing, White	6624-1071
	Cradle Housing, Black	6624-1070
43.	Screw, No. 6-32x1/2	H-0220
44.	Cap Nut, 6-32	H-3146
45.	Nameplate	483-0594

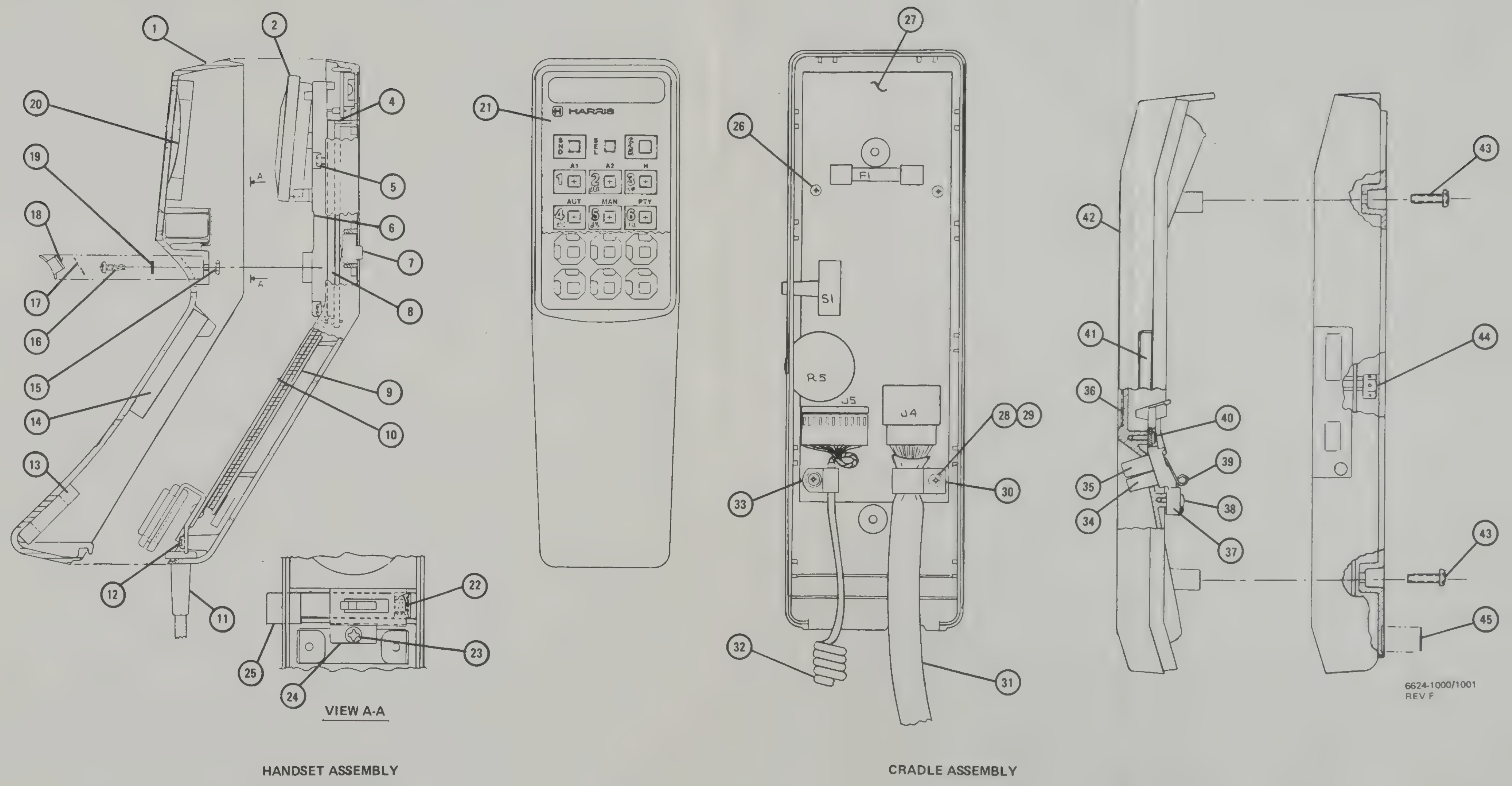


Figure 19. Handset and Cradle Assembly Diagram

TABLE 6

Handset Assembly, Parts List

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
	HANDSET ASSY	6624-1120
C1	Capacitor, Ceramic, 100 pF	C-3501
C2	Capacitor, Tantalum, 3.3 μF	C-3101
C3	Capacitor, Ceramic, 470 pF	C-3508
C4	Capacitor, Ceramic, Disc, 0.01 μF	C-3531
C5	Capacitor, Ceramic, Disc, 0.001 μF	C-3513
C6	Capacitor, Tantalum, 10 μF	C-6738
C7	Capacitor, Ceramic, Disc, 0.01 μF	C-3531
C8	Capacitor, Tantalum, 1.0 μF	C-6733
C9	Capacitor, Tantalum, 100 μF	C-6454
C10	Capacitor, Tantalum, 1.0 μF	C-6733
C11	Capacitor, Ceramic, Disc, 0.01 μF	C-3531
C12	Capacitor, Ceramic, 20 pF	C-4745
C13	Capacitor, Ceramic, 100 pF	C-3501
C14	Capacitor, Ceramic, Disc, 150 pF	C-3502
C15	Capacitor, Ceramic, Disc, 150 pF	C-3502
C16	Capacitor, Ceramic, Disc, 150 pF	C-3502
C17	Capacitor, Ceramic, Disc, 150 pF	C-3502
C18	Not Used	
C19	Capacitor, Ceramic, Disc, 0.01 μF	C-4952
CR1	Diode, Zener, 1N5236	CR-0215
CR2	Not Used	
CR3	Diode, Signal, 1N4454	CR-0705
DS1	Display, Numeric	DS-0225

TABLE 6

Handset Assembly, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
DS2	Lamp, Keyboard	DS-0115
U1	Integrated Circuit, CD4001AE	IC-0135
U2	Integrated Circuit, ML14040BE	IC-0366
U3	Integrated Circuit, TMS-1000	A6624-1180
U4	Integrated Circuit, MC1458CP	IC-0154
U5	Integrated Circuit, CD4051BE	IC-0367
U6	Integrated Circuit, ULN-2004AN	IC-0364
U7	Integrated Circuit, UA7885	IC-0368
J1	Not Used	
J2	Not Used	
J3	Not Used	
J4	Not Used	
J5	Not Used	
J6	Header	J-0432
M1	Microphone	MK-0029
Q1	Transistor, 2N4124	Q-0385
Q2	Transistor, 2N4124	Q-0385
Q3	Transistor, MPS-A13	Q-0076
Q4	Transistor, MPS-A13	Q-0076
Q5	Transistor, MPS-A13	Q-0076
Q6	Transistor, 2N4124	Q-0385
R1	Resistor, Composition, 1Meg, ohm ±5%, ¼W	R-1321
R2	Resistor, Composition, 5.6 K ohm ±5%, ¼W	R-1267
R3	Resistor, Composition, 100K ohm ±5%, ¼W	R-1297

TABLE 6

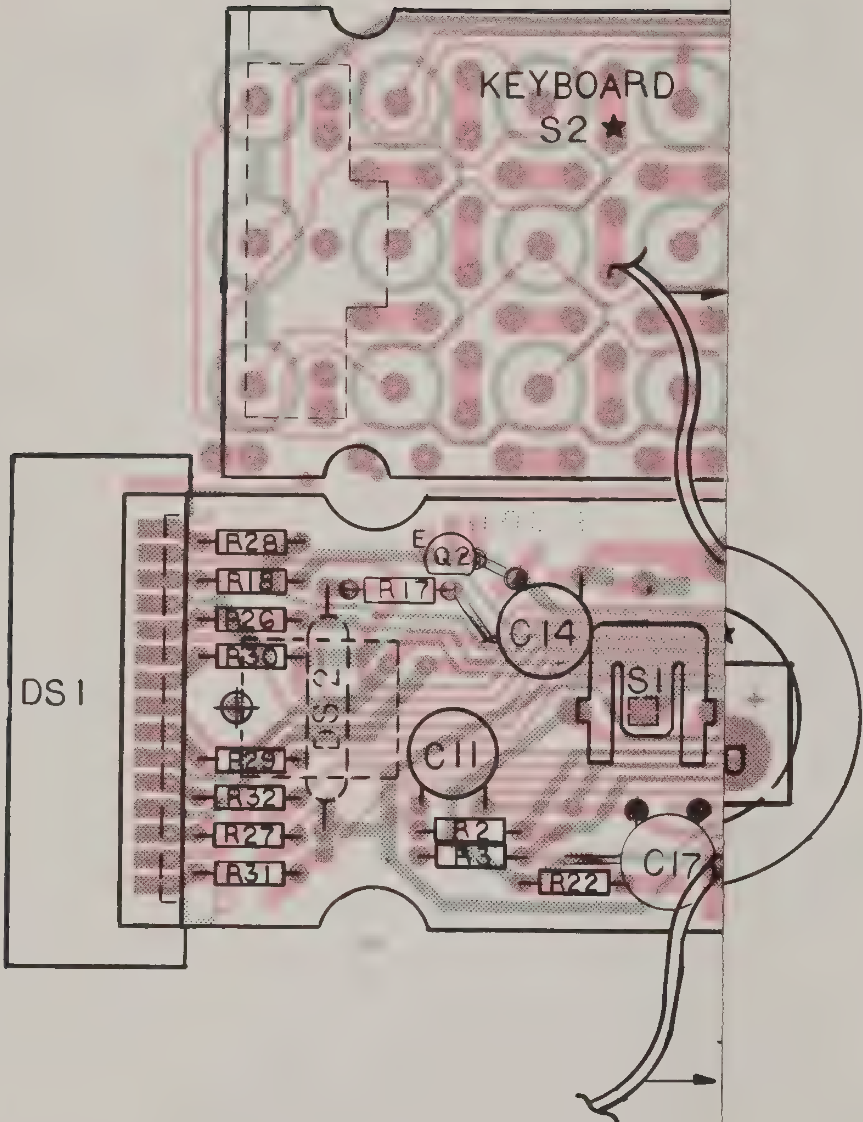
Handset Assembly, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
R4	Resistor, Composition, 10K ohm ±5%, ¼W	R-1273
R5	Resistor, Composition, 820 ohm ±5%, ¼W	R-1247
R6	Resistor, Composition, 470 ohm ±5%, ¼W	R-1313
R7	Resistor, Composition, 15K ohm ±5%, ¼W	R-1277
R8	Resistor, Composition, 220K ohm ±5%, ¼W	R-1305
R9	Resistor, Composition, 6.8K ohm ±5%, ¼W	R-1269
R10	Resistor, Composition, 1.8 ohm ±5%, ¼W	R-1255
R11	Resistor, Composition, 47 ohm ±5%, ¼W	R-1217
R12	Resistor, Composition, 10K ohm ±5%, ¼W	R-1273
R13	Resistor, Composition, 3.3K ohm ±5%, ¼W	R-1261
R14	Resistor, Composition, 3.3K ohm ±5%, ¼W	R-1261
R15	Resistor, Composition, 10K ohm ±5%, ¼W	R-1273
R16	Resistor, Composition, 4.7K ohm ±5%, ¼W	R-1265
R17	Resistor, Composition, 10 ohm ±5%, ¼W	R-1201
R18	Resistor, Composition, 470 ohm ±5%, ¼W	R-1241
R19	Resistor, Composition, 22K ohm ±5%, ¼W	R-1281
R20	Resistor, Composition, 91 ohm ±5%, ¼W	R-1224
R21	Resistor, Composition, 10K ohm ±5%, ¼W	R-1273
R22	Resistor, Composition, 470 ohm ±5%, ¼W	R-1241
R23	Resistor, Composition, 33 ohm ±5%, ½W	R-1413
R24	Resistor, Composition, 200K ohm ±5%, ¼W	R-1305
R25	Resistor, Composition, 47K ohm ±5%, ¼W	R-1289
R26	Resistor, Composition, 470 ohm ±5%, ¼W	R-1241
R27	Resistor, Composition, 470 ohm ±5%, ¼W	R-1241

TABLE 6

Handset Assembly, Parts List (Cont.)

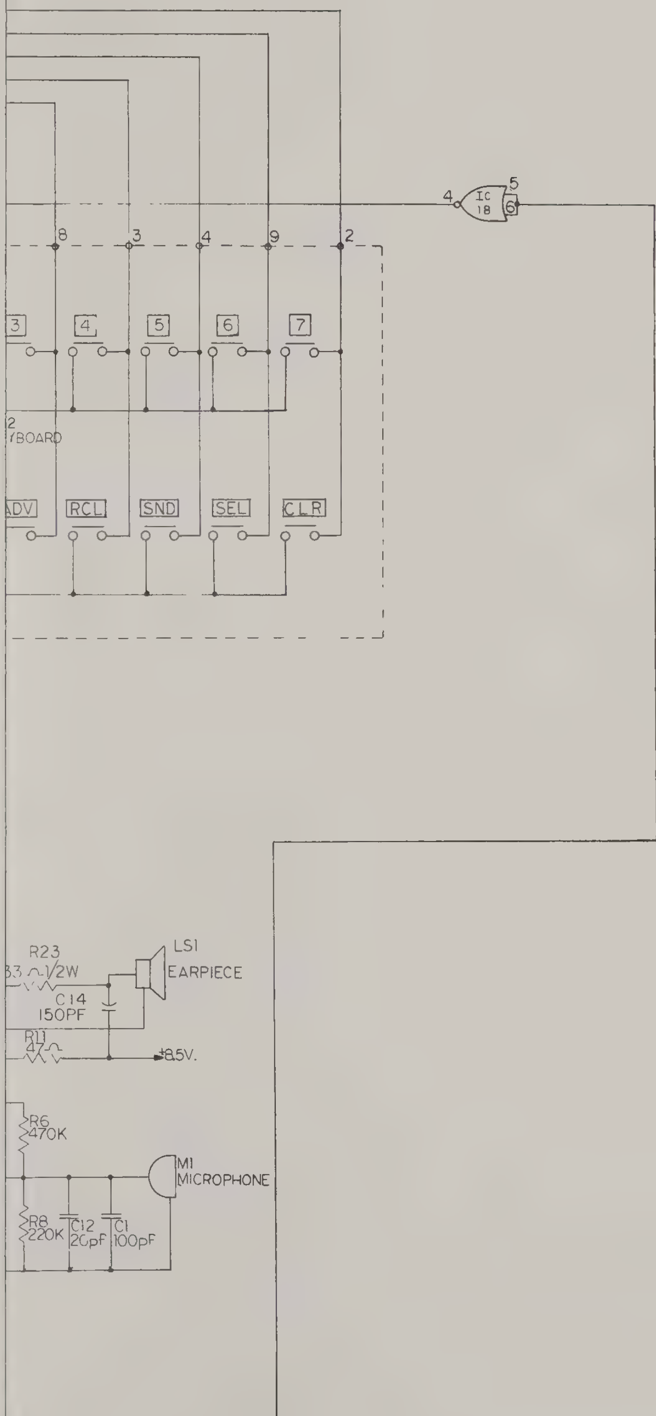
REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
R28	Resistor, Composition, 470 ohm ±5%, ¼W	R-1241
R29	Resistor, Composition, 470 ohm ±5%, ¼W	R-1241
R30	Resistor, Composition, 470 ohm ±5%, ¼W	R-1241
R31	Resistor, Composition, 470 ohm ±5%, ¼W	R-1241
R32	Resistor, Composition, 470 ohm ±5%, ¼W	R-1241
R33	Resistor, Composition, 470 ohm ±5%, ¼W	R-1241
R34	Resistor, Composition, 10K ohm ±5%, ¼W	R-1273
R35	Not Used	
R36	Not Used	
R37	Not Used	
R38	Not Used	
R39	Not Used	
R40	Not Used	
R41	Resistor, Composition, 1K ohm ±5%, ¼W	R-1249
R42	Resistor, Composition, 1.6K ohm ±5%, ¼W	R-1254
RP1	Resistor Package	R-4299
S1	PTT Bar Contact	E-1312
S2	Keyboard	6624-1139
Y1	Crystal, 2.204 MHz	Y-0484



NOTE:

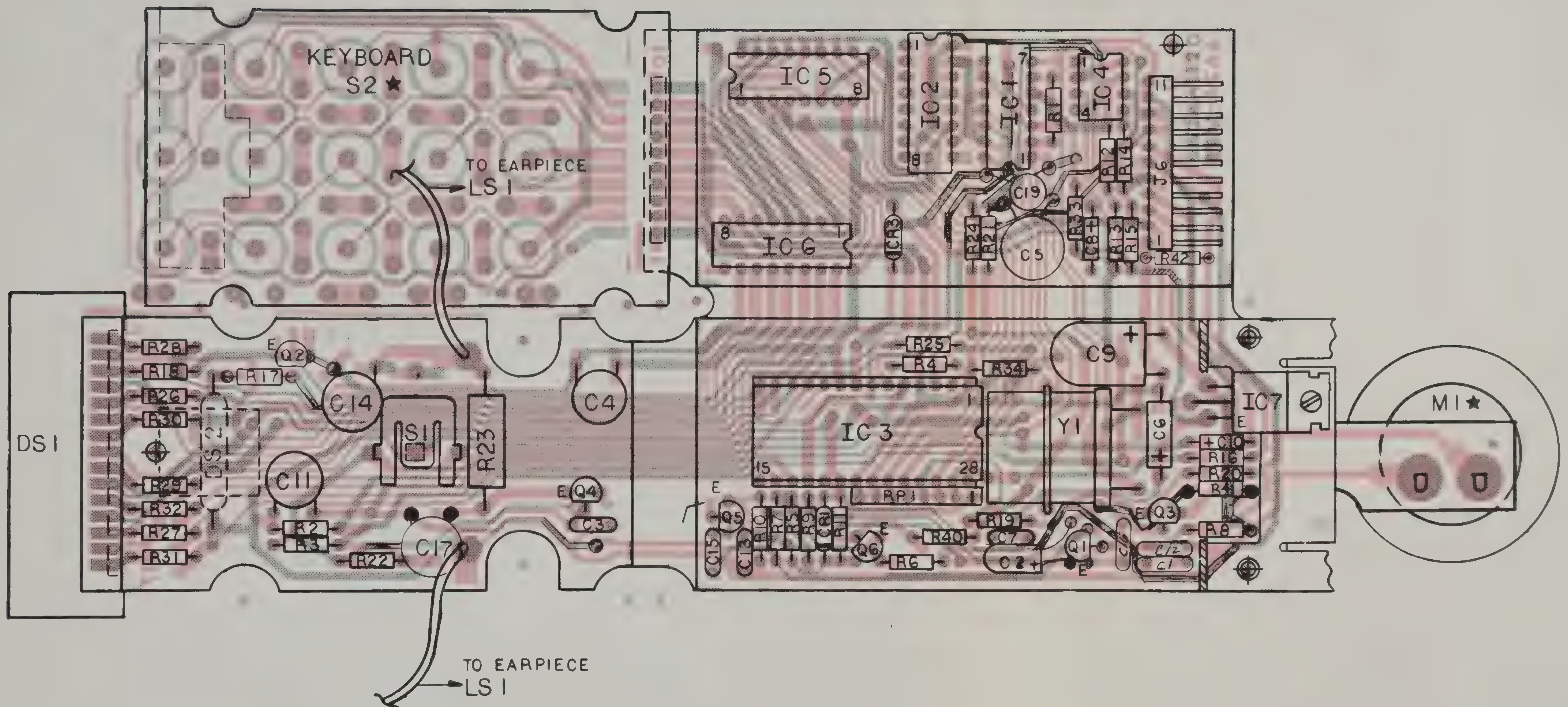
- COMPONENTS SHOWN IN SOLID BLACK
- FACING SIDE FOIL SHOWN IN BLACK SCREEN
- OPPOSITE SIDE FOIL SHOWN IN RED SCREEN

Figure 20. Handset Assembly, Component Location Diagram



TO AUDIO COMMON.

Figure 21. Handset Assembly, Schematic Diagram



NOTE:
- COMPONENTS SHOWN IN SOLID BLACK
- FACING SIDE FOIL SHOWN IN BLACK SCREEN
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Figure 20. Handset Assembly, Component Location Diagram

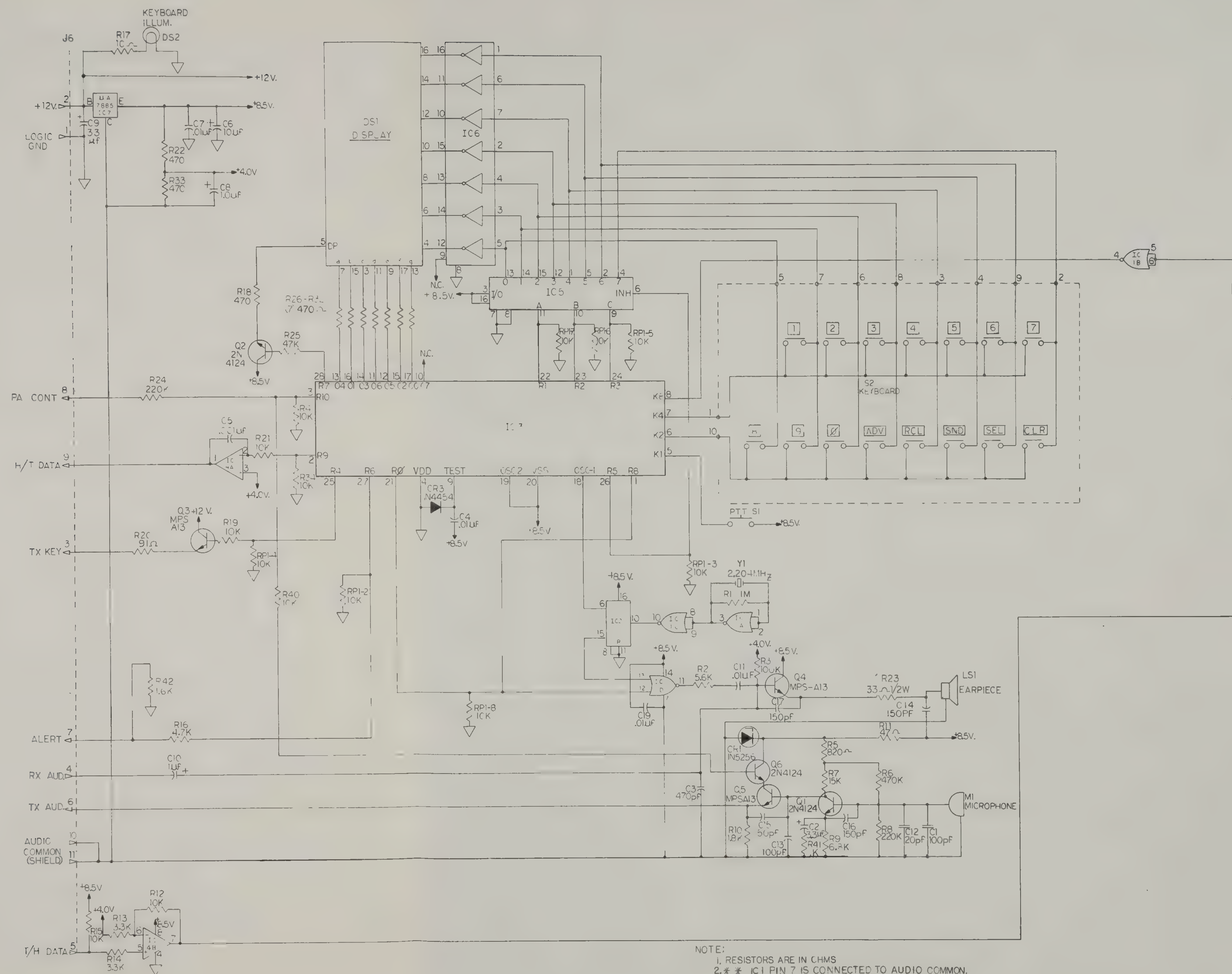


Figure 21. Handset Assembly, Schematic Diagram

TABLE 7

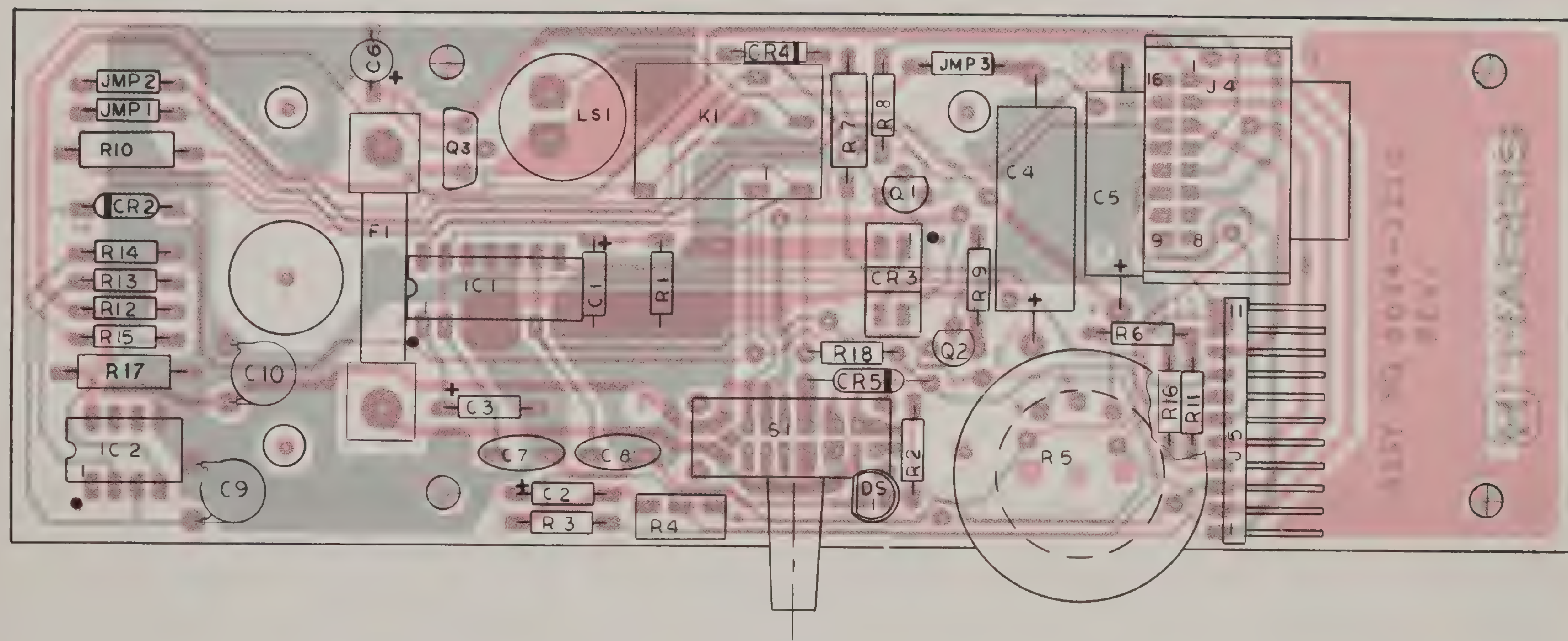
Cradle Assembly, Parts List

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
	CRADLE ASSY	6624-2220
C1	Capacitor, Tantalum, 1.0 μF	C-6733
C2	Capacitor, Tantalum, 1.0 μF	C6733
C3	Capacitor, Tantalum, 4.7 μF	C-6737
C4	Capacitor, Tantalum, 100 μF	C-5847
C5	Capacitor, Tantalum, 150 μF	C-5949
C6	Capacitor, Tantalum, 15 μF	C-3103
C7	Capacitor, Ceramic, Disc, 150 pF	C-3502
C8	Capacitor, Ceramic, Disc, 150 pF	C-3502
CR1	Not Used	
CR2	Diode, Signal, 1N4454	CR-0705
CR3	Source/Sensor	CR-0457
CR4	Diode, 1N4004	CR-0725
CR5	Diode, Zener	CR-0267
DS1	Light Emitting Diode	DS-0226
F1	Fuse, 1A	F-0010
U1	Integrated Circuit, LM-380N	IC-0362
U2	Integrated Circuit, 8212	110-0001-003
J1	Not Used	
J2	Not Used	
J3	Not Used	
J4	Header, Rt. Angle	J-0434
J5	Header, Rt. Angle	J-0432
JMP1	Jumper	MP-1142

TABLE 7

Cradle Assembly, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
K1	Relay	K-0122
Q1	Transistor, 2N4124	Q-0385
Q2	Transistor, MPS-A13	Q-0076
Q3	Transistor, MPS-U51	Q-0072
R1	Resistor, Composition, 22K ohm ±5%, ¼W	R-1281
R2	Resistor, Composition, 100 ohm ±5%, ¼W	R-1225
R3	Resistor, Composition, 75K ohm ±5%, ¼W	R-1294
R4	Potentiometer, 10K	R-2228
R5	Potentiometer, 5K	R-3441
R6	Resistor, Composition, 120 ohm ±5%, ¼W	R-1227
R7	Resistor, Composition, 560 ohm ±5%, ½W	R-1443
R8	Resistor, Composition, 4.7K ohm ±5%, ¼W	R-1265
R9	Resistor, Composition, 47K ohm ±5%, ¼W	R-1289
R10	Varistor, 33V, 300PF	R-4297
R11	Resistor, Composition, 1.8K ohm ±5%, ¼W	R-1255
R12	Resistor, Composition, 82K ohm ±5%, ¼W	R-1295
R13	Resistor, Composition, 221K ohm ±1%, ⅛W	R-7365
R14	Resistor, Composition, 39K ohm ±5%, ¼W	R-1287
R15	Resistor, Composition, 1.2K ohm ±5%, ¼W	R-1251
R16	Resistor, Composition, 4.7K ohm ±5%, ¼W	R-1265
R17	Varistor, 33V, 300PF	R-4297
R18	Resistor, Composition, 47K ohm ±5%, ¼W	R-1289
S1	Switch, OFF/AUX/ON	S-0213
	Knob, Volume	6624-2202



NOTE:
- COMPONENTS SHOWN IN SOLID BLACK
- FACING SIDE FOIL SHOWN IN BLACK SCREEN
- OPPOSITE SIDE FOIL SHOWN IN RED SCREEN

Figure 22. Cradle Assembly, Component Location Diagram

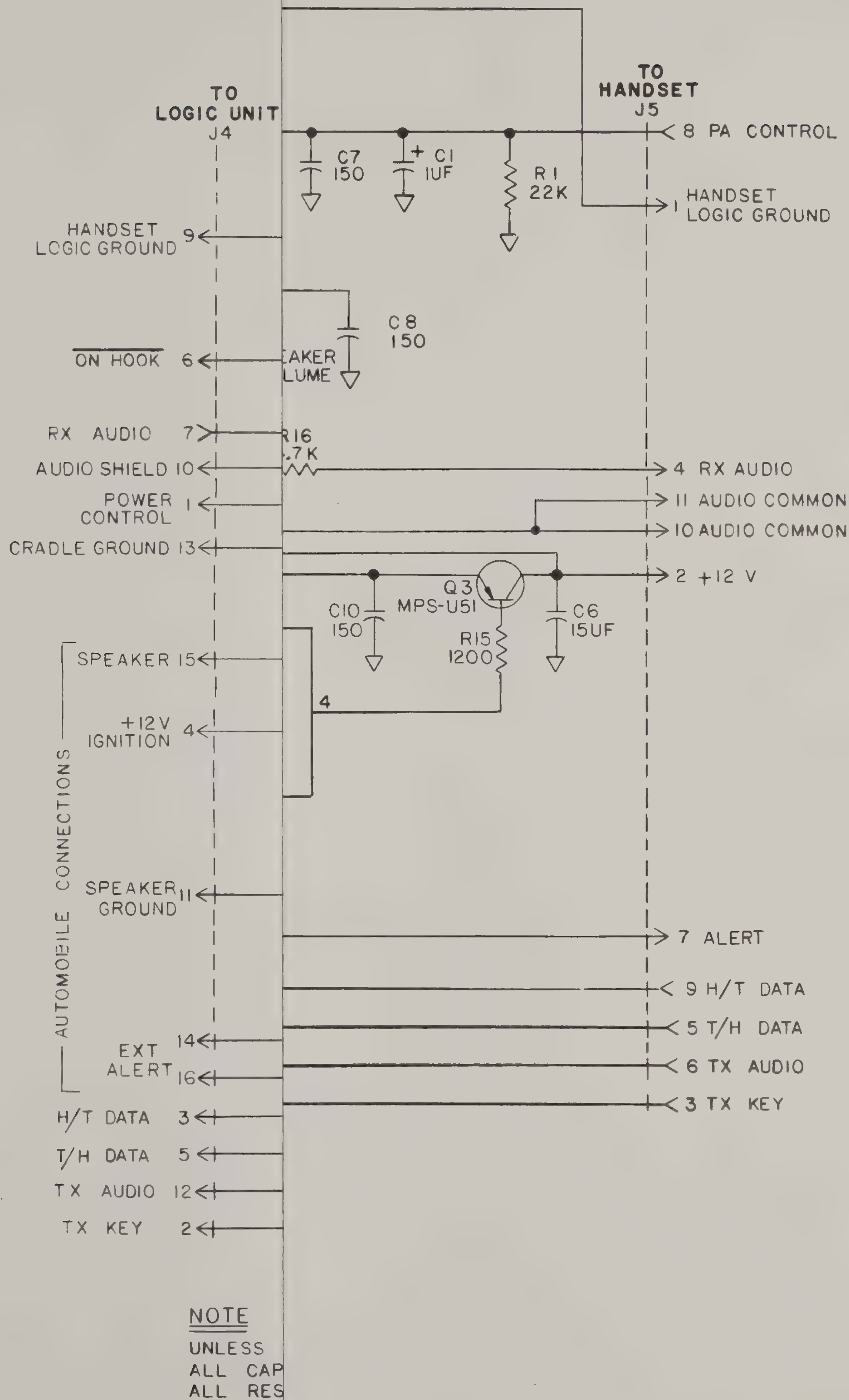
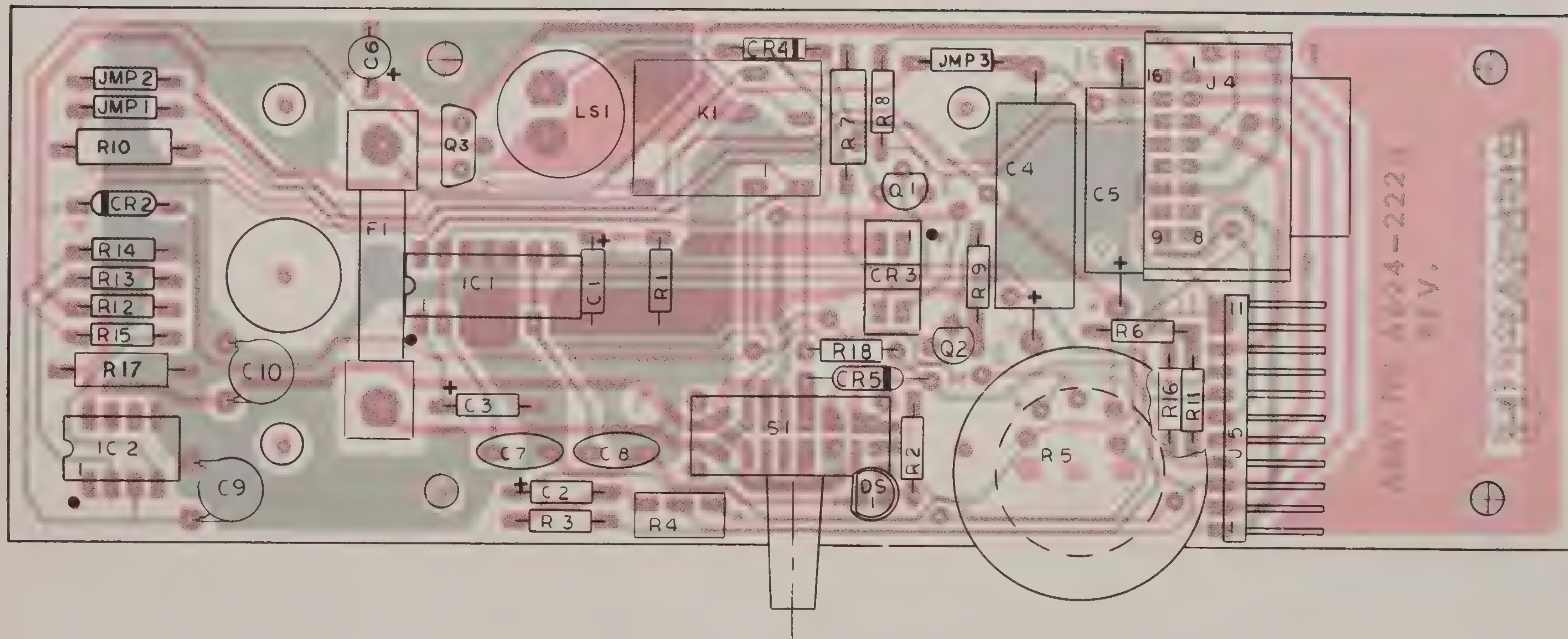
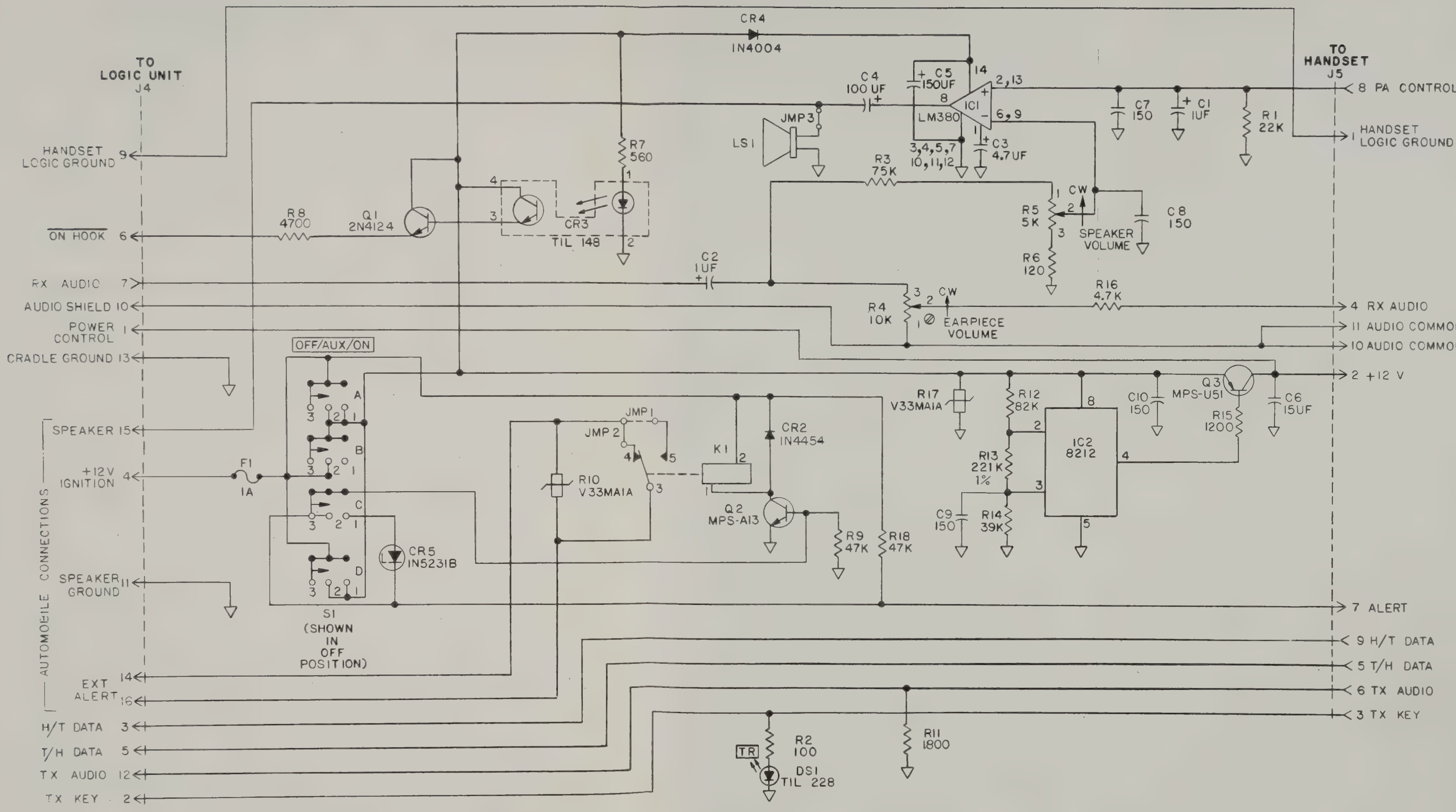


Figure 23. Cradle Assembly, Schematic Diagram



NOTE:
- COMPONENTS SHOWN IN SOLID BLACK
- FACING SIDE FOIL SHOWN IN BLACK SCREEN
- OPPOSITE SIDE FOIL SHOWN IN RED SCREEN

Figure 22. Cradle Assembly, Component Location Diagram



NOTE

UNLESS OTHERWISE SPECIFIED:
ALL CAPACITORS ARE IN PICOFARADS.
ALL RESISTORS ARE IN OHMS AND 1/4 WATT.

Figure 23. Cradle Assembly, Schematic Diagram

TABLE 8

Interface Logic Module, Parts List

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
A8	INTFC LGC MOD, IMTS/MTS	10029-0800
A8	INTFC LGC MOD, IMTS/2805	10029-0810
C1	Capacitor, Ceramic, 0.1 μF, 50V	C-3202
C2	Capacitor, Ceramic, 0.1 μF, 50V	C-3202
C3	Capacitor, Tantalum, 47 μF, 20V	C-5842
C4	Capacitor, Tantalum, 10 μF, 20V	C-6738
C5	Capacitor, Tantalum, 1 μF, 25V	C-6733
C6	Capacitor, Tantalum, 10 μF, 20V	C-6738
C7	Capacitor, Tantalum, 1 μF, 2.5V	C-6733
C8	Capacitor, Polypro, 0.01 μF	6624-3535
C9	Capacitor, Polypro, 0.01 μF	6624-3535
C10	Capacitor, Polypro, 0.01 μF	6624-3535
C11	Capacitor, Polypro, 0.01 μF	6624-3535
C12	Not Used	
C13	Not Used	
C14	Capacitor, Ceramic, 0.47 μF, 50V	C11-0005-474
C15	Capacitor, Ceramic, 0.47 μF, 50V	C11-0005-474
C16	Capacitor, Ceramic, 0.47 μF, 50V	C11-0005-474
C17	Capacitor, Tantalum, 1 μF, 25V	C-6733
C18	Capacitor, Tantalum, 2.2 μF, 20V	C-6734
C19	Capacitor, Tantalum, 0.47 μF, 35V	C-6731
C20	Capacitor	10029-0953
C21	Capacitor, Ceramic, axial, 0.01 μF	C12-0001-056
C22	Capacitor, Ceramic, axial, 0.01 μF	C12-0001-056

TABLE 8

Interface Logic Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
C23	Capacitor, Ceramic, axial, 20 pF	C12-0001-020
C24	Capacitor, Ceramic, axial, 20 pF	C12-0001-020
C25	Capacitor, Tantalum, 4.7 μF, 20V	C-6737
C26	Capacitor, Ceramic, axial, 0.01 μF	C12-0001-056
C27	Capacitor, Ceramic, axial, 0.01 μF	C12-0001-056
C28	Capacitor, Tantalum, 47 μF, 20V	C-5842
C29	Capacitor, Ceramic, axial, 0.01 μF	C12-0001-056
C30	Capacitor, Ceramic, axial, 0.001 μF	C12-0001-049
C31	Capacitor, Ceramic, axial, 0.01 μF	C12-0001-056
C32	Capacitor, Tantalum, 1 uF, 25V	
C34	Capacitor, Ceramic, axial, 0.01 μF	C12-0001-056
C35	Capacitor, Ceramic, axial, 0.001 μF	C12-0001-049
C36	Capacitor, Ceramic, axial, 150 pF	C12-0001-039
C37	Capacitor, Ceramic, axial, 150 pF	C12-0001-039
C38	Capacitor, Ceramic, axial, 150 pF	C12-0001-039
C39	Capacitor, Ceramic, axial, 150 pF	C12-0001-039
C40	Capacitor, Ceramic, axial, 150 pF	C12-0001-039
C41	Capacitor, Ceramic, axial, 150 pF	C12-0001-039
C42	Capacitor, Ceramic, axial, 150 pF	C12-0001-039
C43	Capacitor, Ceramic, axial, 150 pF	C12-0001-039
C44	Capacitor, Ceramic, axial, 12 pF	C12-0001-015
C45	Capacitor, Ceramic, axial, 12 pF	C12-0001-015
C46	Capacitor, Ceramic, axial, 12 pF	C12-0001-015
C47	Capacitor, Ceramic, axial, 12 pF	C12-0001-015

TABLE 8

Interface Logic Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
C48	Capacitor, Ceramic, axial, 12 pF	C12-0001-015
C49	Capacitor, Ceramic, axial, 12 pF	C12-0001-015
C50	Capacitor, Ceramic, axial, 12 pF	C12-0001-015
C51	Capacitor, Ceramic, axial, 12 pF	C12-0001-015
C52	Capacitor, Ceramic, axial, 12 pF	C12-0001-015
C53	Capacitor, Ceramic, axial, 12 pF	C12-0001-015
C54	Capacitor, Ceramic, axial, 12 pF	C12-0001-015
C55	Capacitor, Ceramic, axial, 12 pF	C12-0001-015
C56	Capacitor, Ceramic, axial, 12 pF	C12-0001-015
C57	Capacitor, Ceramic, axial, .01 μF	C12-0001-056
C58	Capacitor, Ceramic, axial, 12 pF	C12-0001-015
CR1	Not Used	
CR2	Diode, Zener, IN5240B	CR-0262
CR3	Diode, Signal, IN4454	CR-0705
CR4	Diode, Signal, IN4454	CR-0705
CR5	Diode, Signal, IN4454	CR-0705
CR6	Diode, Signal, IN4454	CR-0705
CR7	Diode, Epoxy, IN4004	CR-0725
CR8	Diode, Epoxy, IN4004	CR-0725
CR9	Diode, Epoxy, IN4004	CR-0725
CR10	Diode, Epoxy, IN4004	CR-0725
CR11	Diode, Signal, IN4454	CR-0705
CR12	Diode, Signal, IN4454	CR-0705
CR13	Diode, Zener, IN5232B	CR-0265

TABLE 8

Interface Logic Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
CR14	Diode, Signal, IN4454	CR-0705
CR15	Diode, Signal, IN4454	CR-0705
CR16	Diode, Signal, IN4454	CR-0705
CR17	Diode, Signal, IN4454	CR-0705
CR18	Diode, Signal, IN4454	CR-0705
CR19	Diode, Signal, IN4454	CR-0705
DS1	LED, Panel Lamp	919-4314
F1	Fuse, 1 Ampere, 250V	F-0010
J1	Connector, 16-circuit, PCB mount	J41-0001-116
J2	Connector, 18-circuit, PCB mount	J41-0001-008
J3	Connector, 16-circuit, PCB mount	J41-0001-116
J4	Connector, 18-circuit, PCB mount	J41-0001-008
JMP1	Circuit jumper	MP-1142
JMP2	Circuit jumper	MP-1142
JMP3	Circuit jumper	MP-1142
Q1	Transistor, 2N5193	Q-0026
Q2	Transistor, 2N4124	Q-0385
Q3	Transistor, 2N5190	Q-0416
Q4	Transistor, 2N4124	Q-0385
Q5	Transistor, 2N4124	Q-0385
Q6	Transistor, 2N4126	Q-0386
Q7	Transistor, 2N4126	Q-0386
Q8	Transistor, 2N4124	Q-0385
Q9	Not Used	

TABLE 8

Interface Logic Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
Q10	Transistor, 2N4126	Q-0386
Q11	Transistor, 2N4124	Q-0385
R1	Potentiometer, Cermet, 25K ohm	R-2211
R2	Potentiometer, Cermet, 25K ohm	R-2211
R3	Resistor, Composition, 2.2K ohm ±5%, ¼W	R-1257
R4	Resistor, Carbon Film, 27K ohm ±2%, ¼W	R60-0002-092
R5	Resistor, Carbon Film, 82K ohm ±2%, ¼W	R60-0002-104
R6	Resistor, Composition, 270 ohm ±5%, 1W	R-1635
R7	Resistor, Composition, 6.8K ohm ±5%, ¼W	R-1269
R8	Resistor, Composition, 680 ohm ±5%, ¼W	R-1245
R9	Resistor, Composition, 1K ohm ±5%, ¼W	R-1249
R10	Resistor, Carbon Film, 8.2K ohm ±2%, ¼W	R60-0002-080
R11	Resistor, Carbon Film, 8.2K ohm ±2%, ¼W	R60-0002-080
R12	Resistor, Composition, 330 ohm ±5%, ¼W	R-1237
R13	Resistor, Composition, 330 ohm ±5%, ¼W	R-1237
R14	Resistor, Composition, 470K ohm ±5%, ¼W	R-1313
R15	Resistor, Composition, 470K ohm ±5%, ¼W	R-1313
R16	Resistor, Carbon Film, 130K ohm ±2%, ¼W	R60-0002-109
R17	Resistor, Carbon Film, 130K ohm ±2%, ¼W	R60-0002-109
R18 (0800)	Resistor, Film, 7.5K ohm ±1%, 1/8 W	R-7359
R18 (0810)	Resistor, Film, 2.49K ohm ±1%, 1/8 W	R-7277
R19 (0800)	Resistor, Film, 61.9K ohm ±1%, 1/8 W	R-7361
R19 (0810)	Not Used	
R20	Resistor, Film, 4.64K ohm ±1%, 1/8 W	R-7358
R21	Resistor, Film, 4.64K ohm ±1%, 1/8 W	R-7358
R22 (0800)	Resistor, Film, 392K ohm ±1%, 1/8 W	R-7362
R22 (0810)	Resistor, Film, 249K ohm ± 1%, 1/8W	R-7307

TABLE 8

Interface Logic Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
R23	Resistor, Film, 392K ohm ±1%, 1/8 W	R-7362
R24	Potentiometer, 10K ohm	R-4298
R25 (0800)	Potentiometer, 20K ohm	R-4300
R25 (0810)	Not Used	
R26	Potentiometer, 10K ohm	R-4298
R27	Potentiometer, 10K ohm	R-4298
R28	Resistor, Film, 10K ohm ±1%, 1/8 W	R-7338
R29	Resistor, Film, 10K ohm ±1%, 1/8 W	R-7338
R30 (0800)	Resistor, Film, 10K ohm ±1%, 1/8 W	R-7338
R30 (0810)	Resistor, Film, 6.81K ohm ± 1%, 1/8W	R-7285
R31	Resistor, Film, 10K ohm ±1%, 1/8 W	R-7338
R32	Resistor, Film, 10K ohm ±1%, 1/8 W	R-7338
R33	Resistor, Film, 10K ohm ±1%, 1/8 W	R-7338
R34	Resistor, Composition, 100 ohm ±5%, 1/4 W	R-1225
R35	Resistor, Composition, 100 ohm ±5%, 1/4 W	R-1225
R36	Resistor, Carbon Film, 22K ohm ±2%, 1/4 W	R60-0002-090
R37	Resistor, Carbon Film, 22K ohm ±2%, 1/4 W	R60-0002-090
R38	Resistor, Carbon Film, 5.6K ohm ±2%, 1/4 W	R60-0002-076
R39	Resistor, Carbon Film, 5.6K ohm ±2%, 1/4 W	R60-0002-076
R40	Resistor, Carbon Film, 270K ohm ±2%, 1/4 W	R60-0002-116
R41	Resistor, Carbon Film, 270K ohm ±2%, 1/4 W	R60-0002-116
R42	Resistor, Carbon Film, 10K ohm ±5%, 1/4 W	R-1273
R43	Resistor, Composition, 10K ohm ±5%, 1/4 W	R-1273
R44	Resistor, Composition, 10K ohm ±5%, 1/4 W	R-1273
R45	Resistor, Composition, 18 ohm ±5%, 2W	R-1807
R46	Resistor, Carbon Film, 27K ohm ±2%, 1/4 W	R60-0002-092

TABLE 8

Interface Logic Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
R47	Resistor, Carbon Film, 2.7K ohm ±5%, ¼W	R-1259
R48	Not Used	
R49	Resistor, Composition, 10K ohm ±5%, ¼W	R-1273
R50	Resistor, Carbon Film, 27K ohm ±2%, ¼W	R60-0002-092
R51	Resistor, Composition, 10K ohm ±5%, ¼W	R-1273
R52	Resistor, Composition, 10K ohm ±5%, ¼W	R-1273
R53	Resistor, Carbon Film, 27K ohm ±2%, ¼W	R60-0002-092
R54	Resistor, Carbon Film, 33K ohm ±2%, ¼W	R60-0002-094
R55	Resistor, Composition, 10K ohm ±5%, ¼W	R-1273
R56	Not Used	
R57	Resistor, Composition, 10K ohm ±5%, ¼W	R-1273
R58	Resistor, Composition, 2.2K ohm ±5%, ¼W	R-1257
R59	Resistor, Composition, 22K ohm ±5%, ¼W	R-1281
R60	Resistor, Composition, 12K ohm ±5%, ¼W	R-1275
R61	Resistor, Composition, 10K ohm ±5%, ¼W	R-1273
R62	Resistor, Composition, 10K ohm ±5%, ¼W	R-1273
R63	Resistor, Composition, 2.2K ohm ±5%, ¼W	R-1257
R64	Resistor, Composition, 220K ohm ±5%, ¼W	R-1305
R65	Resistor, Composition, 10K ohm ±5%, ¼W	R-1273
R66	Resistor, Composition, 3.9K ohm ±5%, ¼W	R-1263
R67	Resistor, Composition, 10K ohm ±5%, ¼W	R-1273
R68	Resistor, Composition, 3.3K ohm ±5%, ¼W	R-1261
R69	Resistor, Composition, 10K ohm ±5%, ¼W	R-1273
R70	Resistor, Composition, 3.3K ohm ±5%, ¼W	R-1261

TABLE 8

Interface Logic Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
R71	Resistor, Composition, 1K ohm ±5%, ¼W	R-1249
R72	Resistor, Composition, 10K ohm ±5%, ¼W	R-1273
R73	Resistor, Composition, 1.5K ohm ±5%, ¼W	R-1253
R74	Resistor, Composition, 82K ohm ±5%, ¼W	R-1295
R75	Resistor, Composition, 56K ohm ±5%, ¼W	R-1291
R76	Resistor, Composition, 47K ohm ±5%, ¼W	R-1289
R77	Resistor, Composition, 1K ohm ±5%, ¼W	R-1249
R78	Resistor, Composition, 3.9K ohm ±5%, ¼W	R-1263
R79	Resistor, Composition, 4.7K ohm ±5%, ¼W	R-1265
R80	Resistor, Composition, 4.7K ohm ±5%, ¼W	R-1265
R81	Resistor, Composition, 4.7K ohm ±5%, ¼W	R-1265
R82	Resistor, Composition, 4.7K ohm ±5%, ¼W	R-1265
R83	Resistor, Composition, 4.7K ohm ±5%, ¼W	R-1265
R84	Resistor, Composition, 4.7K ohm ±5%, ¼W	R-1265
R85	Not Used	
R86	Resistor, Carbon Film, 43K ohm ±2%, ¼W	R60-0002-097
R87	Resistor, Film, 200K ohm ±1%, ⅛W	R-7317
R88	Resistor, Carbon Film, 33K ohm ±2%, ¼W	R60-0002-094
R89	Resistor, Composition, 2.7K ohm ±5%, ¼W	R-1259
R90	Resistor, Composition, 1K ohm ±5%, ¼W	R-1249
R91	Not Used	
R92	Resistor, Composition, 1.8K ohm ±5%, ¼W	R-1255
R93	Resistor, Composition, 33K ohm ±5%, ¼W	R-1285
R94	Resistor, Composition, 330 ohm ±5%, ¼W	R-1237

TABLE 8

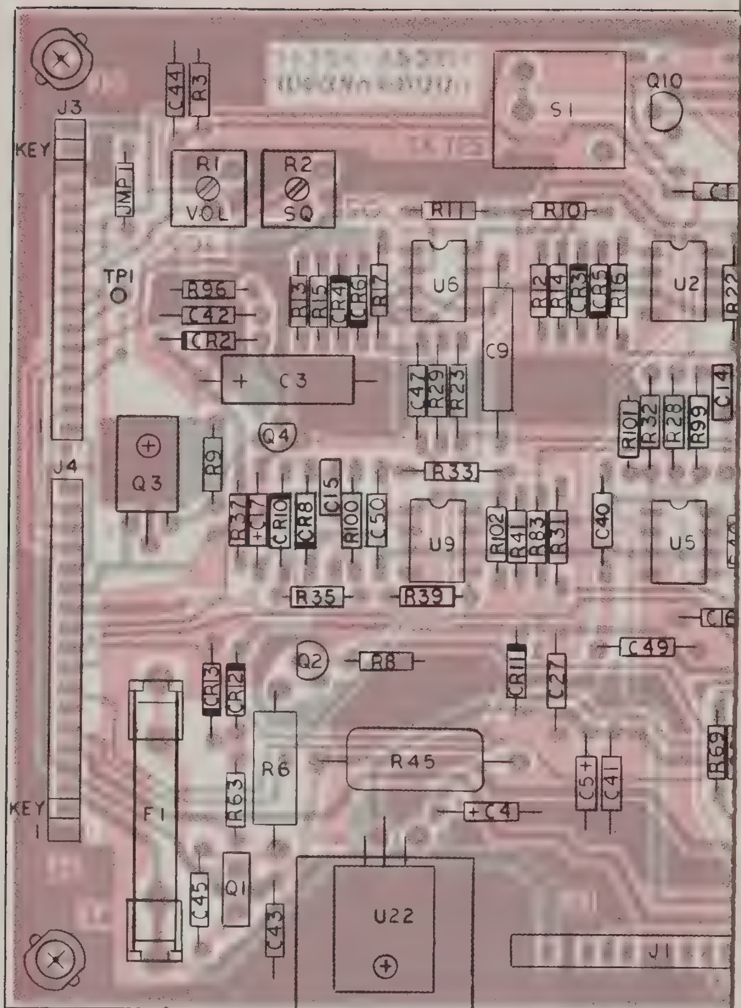
Interface Logic Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
R95	Potentiometer, Cermet, 5K ohm	R-2208
R96	Resistor, Composition, 330 ohm ±5%, ¼W	R-1237
R97	Resistor, Composition, 10K ohm ±5%, ¼W	R-1273
R98	Resistor, Composition, 10K ohm ±5%, ¼W	R-1273
R99	Resistor, Composition, 200 ohm ±5%, ¼W	R-1233
R100	Resistor, Composition, 200 ohm ±5%, ¼W	R-1233
R101	Resistor, Composition,2.2Kohm ±5%, ¼W	R-1257
R102	Resistor, Composition,2.2Kohm ±5%, ¼W	R-1257
S1	Switch	S05-0003-001
U1	Integrated Circuit, MC1458CP	IC-0154
U2	Integrated Circuit, CA3240E	I30-0024-000
U3	Not Used	
U4	Not Used	
U5	Integrated Circuit, CA3240E	I30-0024-000
U6	Integrated Circuit, CA3240E	I30-0024-000
U7	Integrated Circuit, CA3240E	I30-0024-000
U8	Integrated Circuit, MC1458CP	IC-0154
U9	Integrated Circuit, CA3240E	I30-00024-000
U10	Integrated Circuit, Motorola MC1458CP	IC-0154
U11	Integrated Circuit, RCA CD4066BE	IC-0379
U12	Integrated Circuit, TI SN74LS175	IC-0371
U13	Integrated Circuit, TI SN74LS175	IC-0371
U14	Integrated Circuit, RCA CD4066BE	IC-0379
U15	Integrated Circuit, Motorola MCM145101P	IC-0431

TABLE 8

Interface Logic Module, Parts List (Cont.)

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
U16	Code Plug, SN74S288 PROM	IC-0373
U17	Integrated Circuit, TI SN74LS26N	IC-0372
U18	Integrated Circuit, RCA CD4049BE	IC-0369
U19	Microcomputer, Intel 8035	IC-0374
U20	Memory Program	Consult Customer Service
U21	Integrated Circuit, TI SN74LS26N	IC-0372
U22	Integrated Circuit, Voltage Regulator 7805	IC-0151
U23	Integrated Circuit, Voltage Regulator 7805	IC-0151
U24	Detector, Intersil 8211	I10-0001-001
Y1	Crystal, Quartz, 5.185 MHz	Y-0706
	Fuse Clip, PCB Mount	Z19-0009-000
	Insulator, Crystal	6630-2130
	Heat Sink, Black Aluminum	X-0817
	Socket, IC, 14-pin	J76-0014-001
	Socket, IC, 16-pin	J76-0016-001
	Socket, IC, 22-pin	J76-0022-001
	Socket, IC, 24-pin	J76-0024-001
	Socket, IC, 40-pin	J76-0040-001



NOTE:
- COMPONENTS SHOWN IN SOLID BLACK
- FACING SIDE FOIL SHOWN IN BLACK SCREEN
- OPPOSITE SIDE FOIL SHOWN IN RED SCREEN

Figure 24. Interface Logic Module, Component Location Diagram

HEAD

OL IN

OUT

D

GND

NOTES: UNLESS OTHERWISE SPECIFIED

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER AND/OR ASSEMBLY DESIGNATION.
2. RESISTOR VALUES ARE IN OHMS, 1/4W, 5%.
3. VENDOR AND/OR JEDEC PART NUMBER CALLOUTS ARE FOR REFERENCE ONLY; COMPONENTS ARE SUPPLIED PER PART NUMBER IN PARTS LIST.

NO.	GND	+5V	+10V	+BATT
U	PIN	PIN	PIN	PIN
1, 2, 5-10,	4	—	8	—
12, 13, 16	8	16	—	—
11, 14	7	—	14	—
8	8	1	—	—
24	5	—	—	8
15	8	22	—	—
20	12	24	—	—
19	20	26,40	—	—
7,21	7	14	—	—

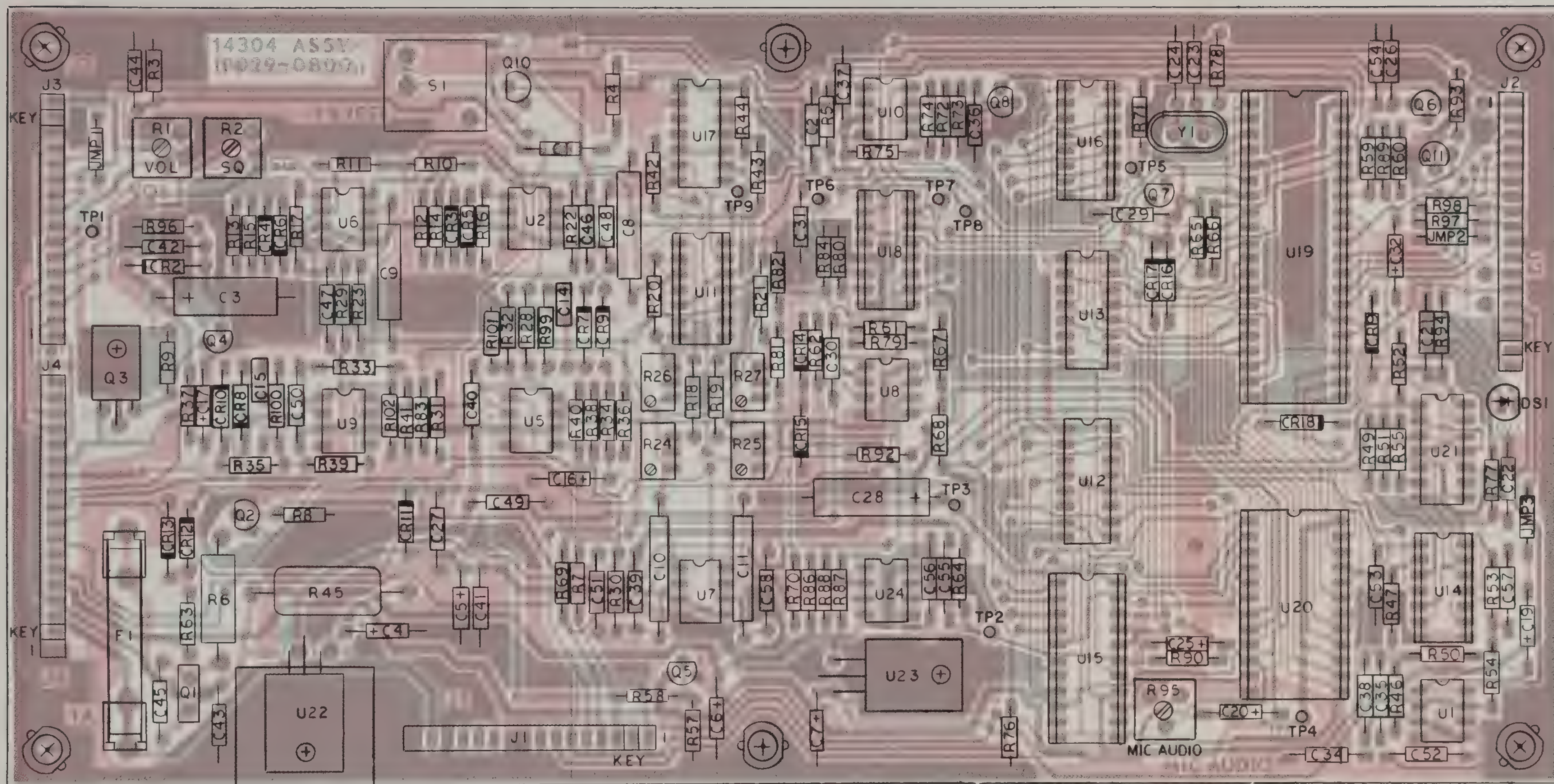
	10029-0800 (MTS)	10029-0810 (RCC)
R18	7.5K	2.49K
R 9	61.9K	NOT USED
R22	392K	249K
R25	10K	NOT USED
R30	10K	6.81K
JMP 2	CUT	IN

	IN	OUT
JMP 1	NORMAL	SPECIAL
JMP 3	NORMAL	SPECIAL

U PART NO.

U NO	J PART NO
1	MC1458CP
2	CA3240E
5	
6	
7	
8	MC1458CP
9	CA3240E
10	MC1458CP
11	CD4066BE
12	74LS175N
13	74LS175N
14	CD4066BE
15	MCM14510IP
16	74LS288
17	74LS26N
18	CD4049BE
19	MICRO PROCESSOR 8035
20	ROM, IMTS/MTS
21	74LS26N
22	MC7805CP
23	MC7805CP
24	ICL8211

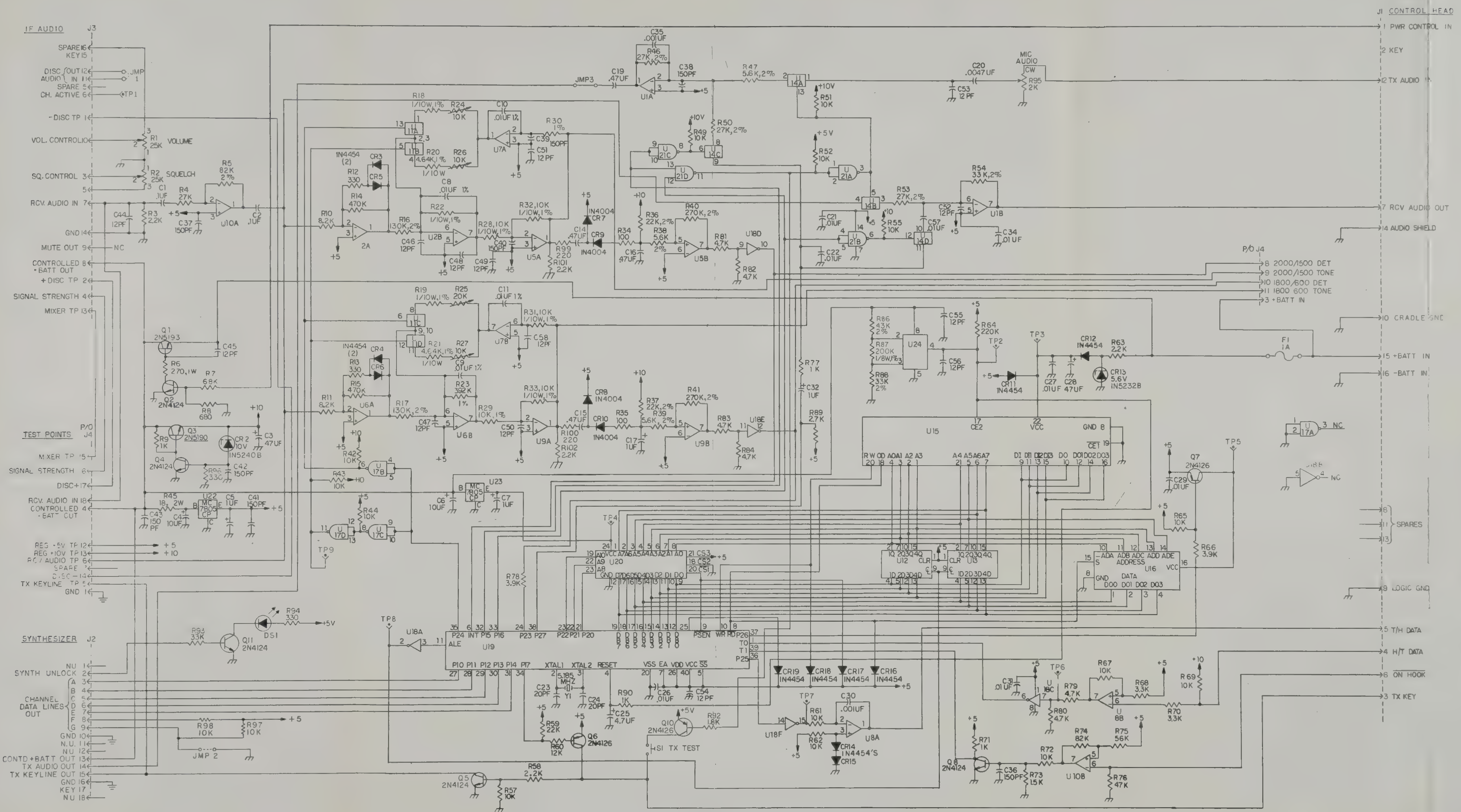
ure 25. Interface Logic Module, Schematic Diagram



NOTE:

- COMPONENTS SHOWN IN SOLID BLACK
- FACING SIDE FOIL SHOWN IN BLACK SCREEN
- OPPOSITE SIDE FOIL SHOWN IN RED SCREEN

Figure 24. Interface Logic Module, Component Location Diagram



NOTES: UNLESS OTHERWISE SPECIFIED

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER AND/OR ASSEMBLY DESIGNATION.
2. RESISTOR VALUES ARE IN OHMS, 1/4W, 5%.
3. VENDOR AND/OR JEDEC PART NUMBER CALLOUTS ARE FOR REFERENCE ONLY; COMPONENTS ARE SUPPLIED PER PART NUMBER IN PARTS LIST.

U NO.	GND	+5V	+10V	+BATT
U	PIN	PIN	PIN	PIN
1,2,5-10,	4	—	8	—
12, 13,16	8	16	—	—
11,14	7	—	14	—
8	8	[illegible]	—	—
24	5	—	—	8
15	8	22	—	—
20	12	24	—	—
19	20	26,40	—	—
17,21	7	14	—	—

	10029-0800 (MTS)	10029-0810 (RCC)
R[illegible]	[illegible]	[illegible]
R[illegible]	[illegible]	NOT USED
R22	392K	249K
R25	10K	NOT USED
R30	10K	[illegible]
[illegible]	OUT	IN

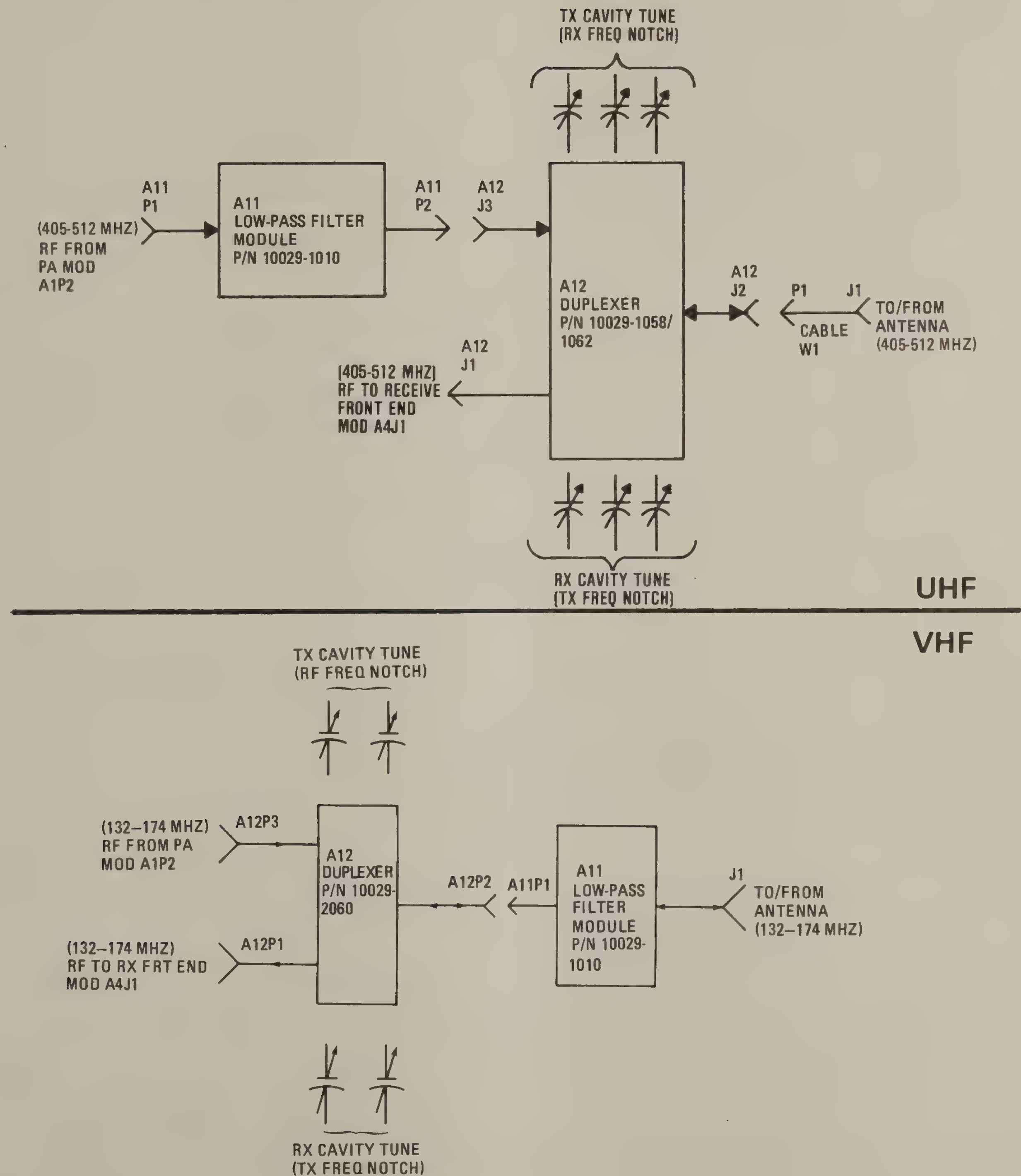
U PART NO.

U NO	U PART NO
1	MC1458CP
2	CA324CE
5	
6	
7	
8	MC1458CP
9	CA3240E
[illegible]	[illegible]
11	CD40[illegible]BE
12	74LS175N
13	74LS175N
14	CD4066BE
15	[illegible]
16	74LS288
17	74LS26N
18	CD4049BE
19	MICRO PROCESSOR 8C35
[illegible]	ROM, IMTS/MTS
[illegible]	[illegible]
22	[illegible]
23	MC7805CP
24	ICL8211

Figure 25. Interface Logic Module, Schematic Diagram

A11/A12

LPF MOD & DPLXR



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LIST OF TABLES

1. GENERAL DESCRIPTION

1.01 Interface information for the UHF/VHF Low-Pass Filter Module A11 and Duplexer Module A12 is shown on the tab cover diagrams. The function of the Low-Pass Filter Module in the Transceiver is to provide rejection of harmonics in the PA Module output signal. The function of the Duplexer is to allow simultaneous operation of the Receiver and Transmitter at different frequencies on a single antenna. The different types of Duplexers are listed in table 1A and 1B.

TABLE 1A

Available UHF Duplexers

Duplexer	Adjustment Range	Test Frequency MHz	Rx/Tx Split MHz
10029-1056	406-430	Rx 416	5-9
		Tx 421	
10029-1057	430-450	Rx 438	5-9
RCC		Tx 443	
10029-1058	450-470	Rx 454.200	5-9
Telco		Tx 459.200	
10029-1059	450-470	Rx 454.500	5-9
		Tx 459.500	
10029-1061	470-490	Rx 478	5-9
		Tx 483	
10029-1062	490-512	Rx 498	5-9
		Tx 503	

TABLE 1B

Available VHF Duplexers

Duplexer	Adjustment Range	Test Frequency MHz	Rx/Tx Split MHz
10029-2059	132-150	Rx 139	4.7-6
RCC		Tx 144	
10029-2060	150-174	Rx 152.100	4.7-6
Telco		Tx 158.560	
10029-2061	150-174	Rx 152.660	4.7-6
		Tx 157.920	

For other Rx/Tx combinations contact the factory.

2. INTERFACE CONNECTIONS

A. UHF Low-Pass Filter Module and Duplexer Interface Connections

2.01 Table 2 summarizes all UHF interface functions for the Low-Pass Filter Module and Duplexer and gives significant TO/FROM information.

TABLE 2

UHF Low-Pass Filter and Duplexer Interface Summary

REF DESIG	FUNCTION	TO	FROM
A11P1	Tx Rf In	—	A1P2
A11P2	Tx Rf Out	A12J3	—
A12J1	Rx Rf In	A4J1	—
A12J2	Tx/Rx Rf	Ant	Ant
A12J3	Tx Rf In	—	A11P2

TABLE 3

VHF Low-Pass Filter and Duplexer Interface Summary

REF DESIG	FUNCTION	TO	FROM
A11P1	Tx/Rx Rf	—	P2
A11J1	Tx/Rx Rf	Ant	Ant
A12P1	Rx Rf Out	A4J1	—
A12P3	Tx Rf In	—	A1P2

3. SUPPLEMENTARY SEMICONDUCTOR DATA

3.01 Neither the UHF nor the VHF Low-Pass Filter Module and Duplexer contain any complex semiconductor devices. Therefore, no supplementary semiconductor data is required.

4. TECHNICAL DESCRIPTION

A. UHF/VHF Low-Pass Filter Module Description

4.01 Both the UHF and VHF Low-Pass Filter Modules are built on a plate designed for installation in a cavity on the chassis. The typical insertion loss of the Low-Pass Filter Modules is 0.3 dB. Harmonic rejection is greater than 55 dB.

B. UHF/VHF Duplexer Description

4.02 Both the UHF and VHF Duplexers are band reject types with high Q resonant cavities connected together by ¼ wave lines. For UHF there are three cavities for transmit and three cavities for receive. In the VHF Duplexer there are two cavities for transmit and two cavities for receive. In transmit, both Duplexers provide low insertion loss at the transmit frequency and notch out the Transmitter noise at the receive frequency. In the Receiver side, the Duplexers provide low insertion loss at the receive frequency, and a notch at the transmitter frequency. Using this method, simultaneous operation of both Transmitter and Receiver on one antenna can be achieved. This is commonly referred to as full duplex operation.

4.03 Typical UHF Duplexer specifications are 70 dB isolation over a 350 KHz bandwidth for transmit and receive, while the VHF unit is 75 dB isolation over a 300 KHz bandwidth for rejection of the transmit frequency and 65 dB over a 300 KHz bandwidth for rejection of the receive frequency. Insertion loss is approximately 1 dB for both Duplexers.

5. MAINTENANCE

A. General Information

5.01 All significant signal inputs and outputs are shown on the tab cover diagrams. The adjustments indicated by the alignment procedures described in these paragraphs are made at the factory prior to shipment. Normally, it should not be necessary to repeat any of these adjustments unless there are component failures or unless readjustment becomes necessary for some other specific reason. Removal of the Transceiver cover facilitates the maintenance and adjustment of the Duplexer. These adjustments can be made using the test equipment shown in figure 1 or their equivalents. There are no adjustments required for the Low-Pass Filter Modules.

CAUTION

Always disconnect power when removing or installing subassemblies.

B. Duplexer Alignment

CAUTION

The UHF Duplexer uses a fixed tensioning device to preload the adjustment screws. Any attempt to adjust this tensioning device may impair its function.

(a) For UHF, connect test equipment as shown in figure 1, and in figure 2A, and select center frequency at Control Unit.

(b) For VHF, connect test equipment (except dummy load - see figure 2B) as shown in figure 1, and 2B, and select center frequency at Control Unit.

(c) On UHF Duplexer, remove four screws holding Duplexer to main chassis and lift Duplexer up so that alignment screws are accessible.

(d) On VHF Duplexer, removal of hold-down screws is not necessary.

(e) Loosen locking (VHF only) nuts on receive cavity alignment controls just enough to allow alignment.

(f) Key Transceiver and carefully adjust Receiver cavity controls for a minimum indication on rf voltmeter.

(g) Repeat adjustment of Receiver cavity controls until rf voltmeter indication stabilizes at less than eight millivolts.

(h) Carefully tighten receive cavity adjustment lock nuts (VHF only) while holding adjustment control to prevent degradation of alignment. Recheck to see that alignment has not changed.

(i) Unkey Transceiver and restore connections in the Transceiver. For VHF connect dummy load to Transceiver.

(j) Connect Transceiver to test equipment as shown in figure 3A (UHF), or 3B (VHF).

(k) Adjust FM signal generator output to 100 millivolts minimum, using rf voltmeter at receive frequency selected in step (a). Verify frequency using frequency counter.

(l) Connect a dc voltmeter to Interface Logic Module A8 Signal Strength test point A8J4-16 (+) and Ground test point A8J4-1 (−) as shown in figure 3.

(m) Loosen lock nuts on the transmit cavity alignment controls (VHF only) just enough to allow adjustment.

(n) Carefully adjust transmit cavity controls for a minimum indication on dc voltmeter.

(o) Repeat transmit Duplexer adjustment until indication stablizes.

(p) Carefully tighten transmit cavity adjustment lock nuts (VHF only) while holding adjustment control to prevent degradation of alignment. Recheck to see that alignment has not changed.

(q) Restore all connections and fasten Duplexer to main chassis, if removed.

6. PARTS LIST

A. UHF/VHF Low-Pass Filter Module, Parts List

6.01 The parts list information for both UHF and VHF Low-Pass Filter Modules is shown in table 3, while figure 4 gives UHF Low-Pass Filter Module component location information and figure 5 gives the VHF Low-Pass Filter Module component location information.

B. UHF/VHF Duplexer, Parts List

6.02 The parts list information for both the UHF and VHF Duplexers is not required as they are not field repairable.

7. SCHEMATIC DIAGRAMS

A . UHF/VHF Low-Pass Filter Modules

7.01 There are no schematic diagrams for either the UHF or the VHF Low-Pass Filter Modules.

B. UHF/VHF Duplexer

7.02 Schematic diagrams for the UHF and the VHF Duplexer are not provided because they are not field repairable items.

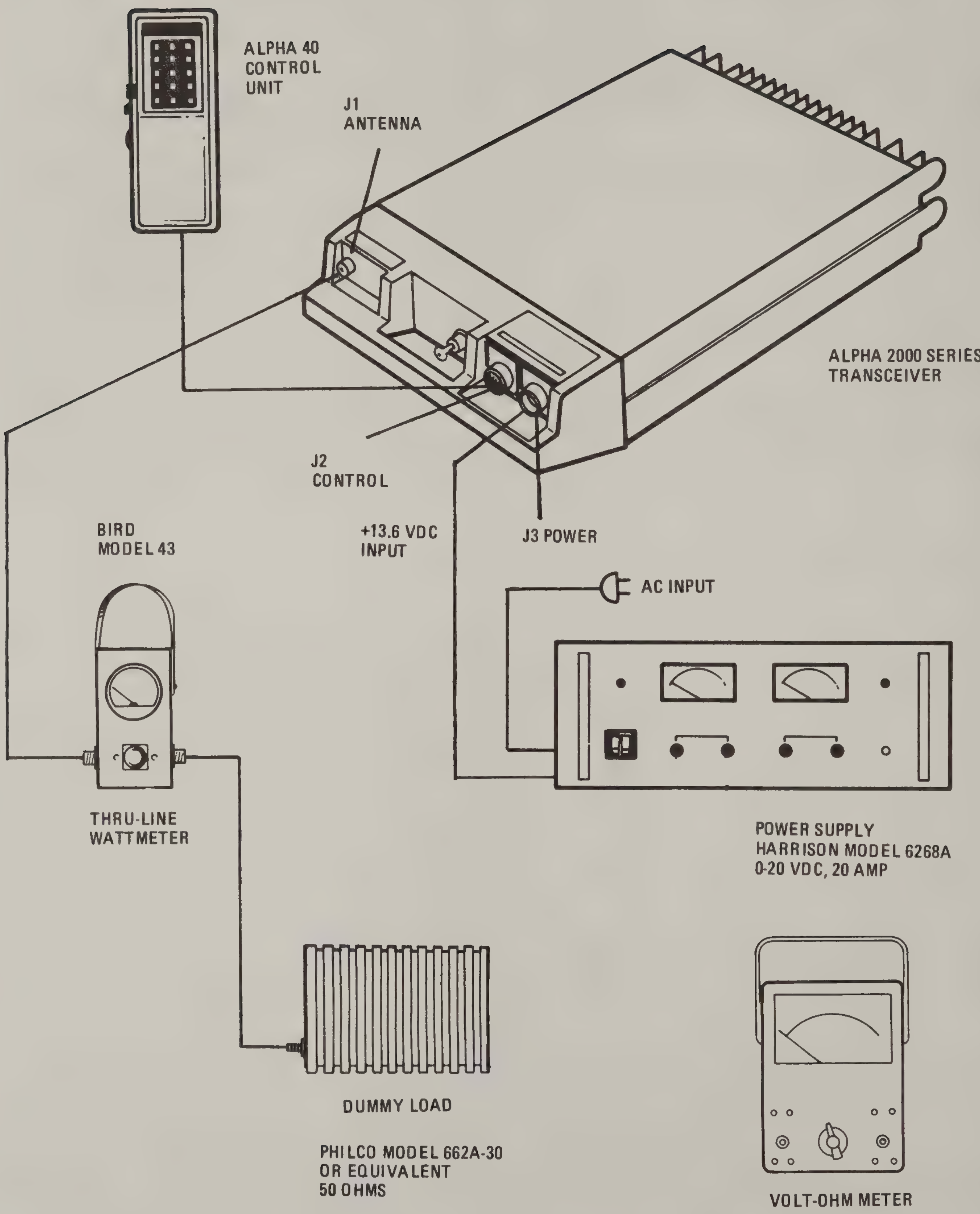

Figure 1. UHF/VHF Duplexer, Test Setup

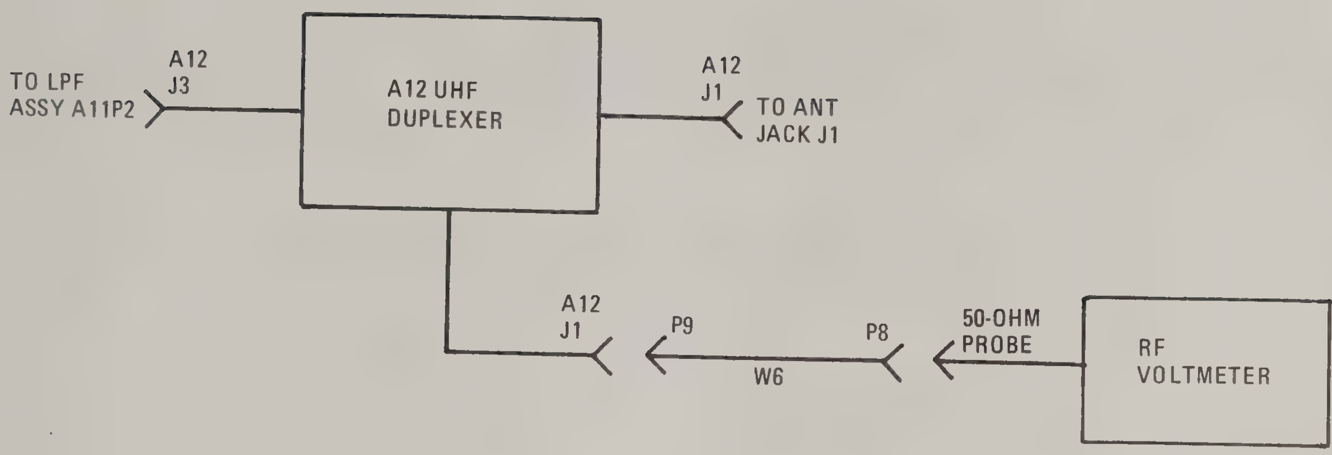

Figure 2A. UHF Duplexer, Test Setup, Adjusting Receive Cavities for Transmit Frequency Notch

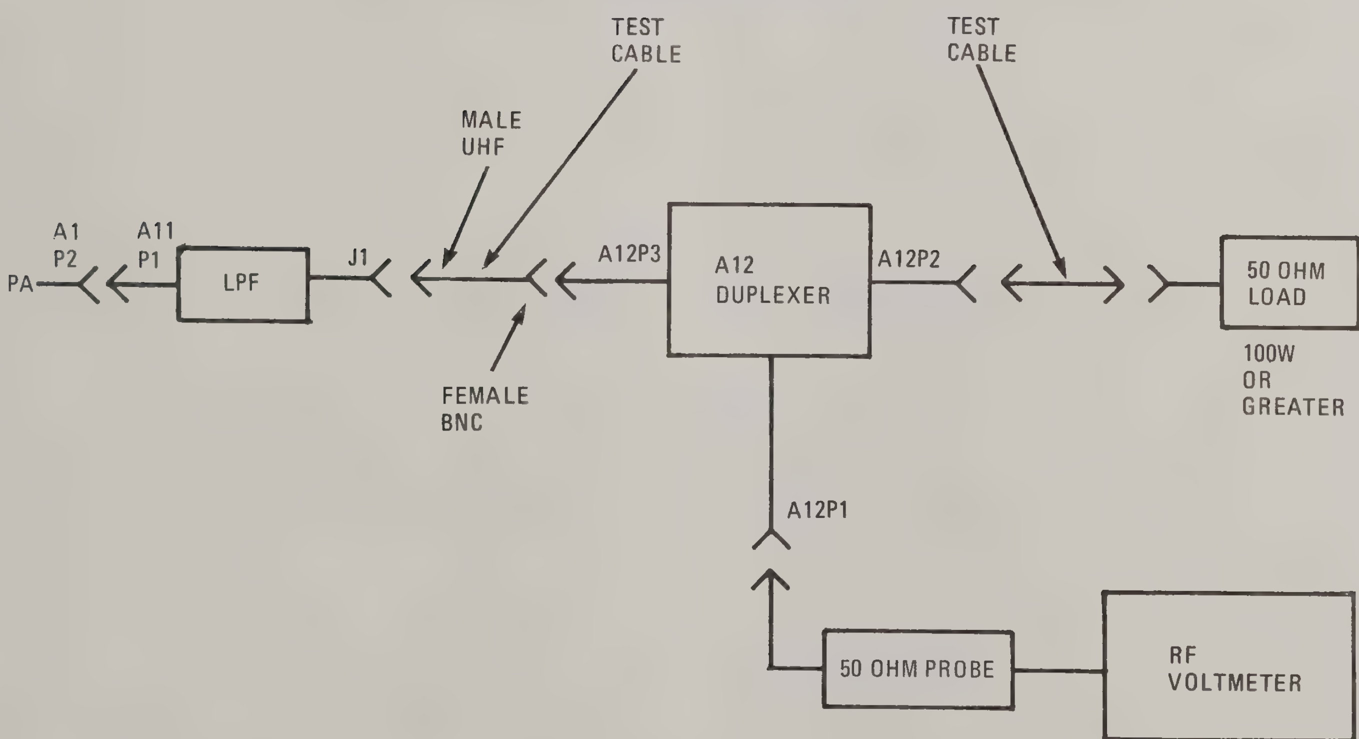

Figure 3A. VHF Duplexer. Test Setup, Adjusting Transmit Cavities for Receive Frequency Notch

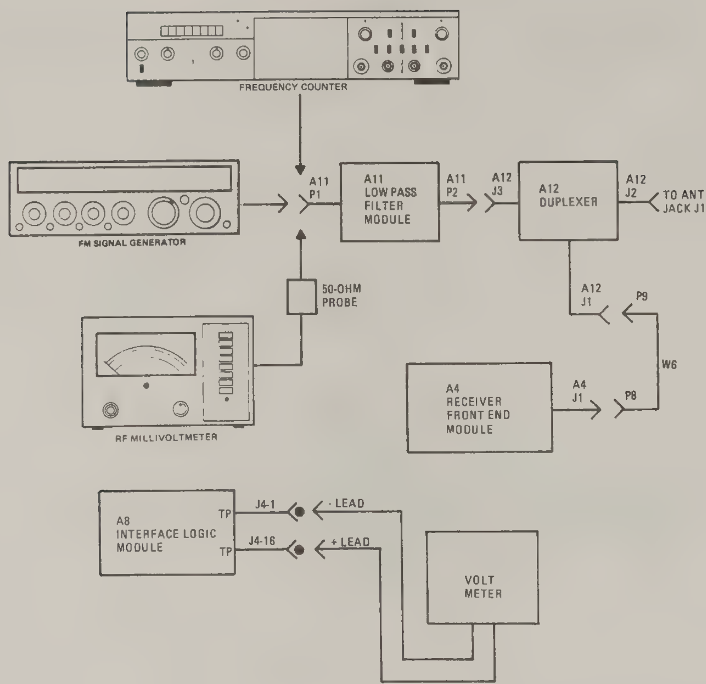

Figure 3A. Third UHF Duplexer, Test Setup Adjusting Transmit Cavities For Receive Frequency Notch

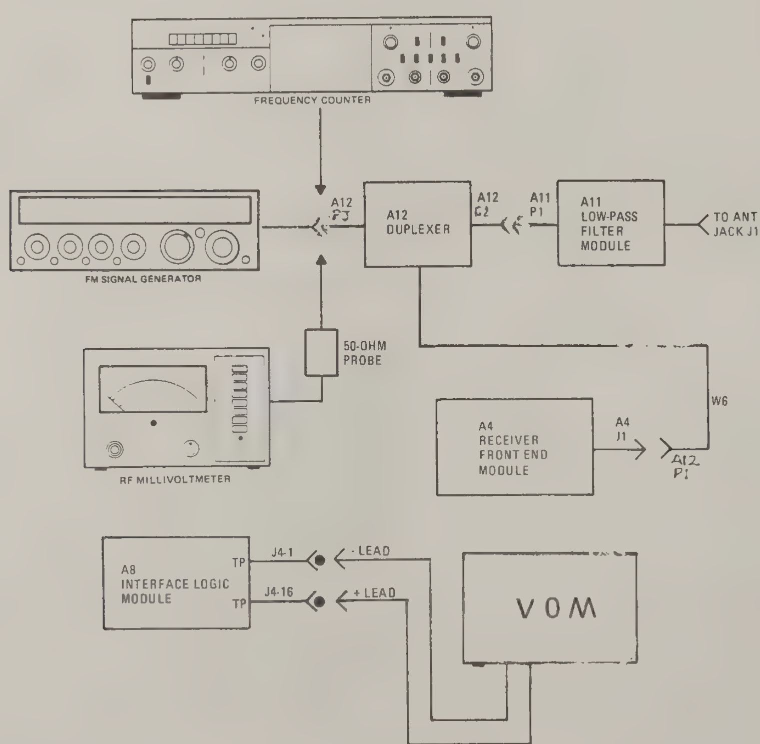

Figure 3B. VHF Duplexer Test Setup, Adjusting Transmit Cavities for Receive Frequency Notch

TABLE 4

UHF/VHF Low-Pass Filter Module, Parts List

REF. DESIG.	NAME OF PART AND DESCRIPTION	RF PART NO.
A11	UHF LPF MOD	10029-1010
C1	Capacitor, Silver Mica, 13 pF, 350V	C-6679
C2	Capacitor, Silver Mica, 13 pF, 350V	C-6679
C3	Capacitor, Silver Mica, 6.2 pF, 350V	C-6675
C4	Capacitor, Silver Mica, 6.2 pF, 350V	C-6675
	Cover Plate	10029-0065
	Coaxial Assembly, Input (Includes A11P1)	10029-0012
	Coaxial Assembly, Output (Includes A11P2)	10029-0012
A11	VHF LPF MOD	10029-2010
C1	Capacitor, Silver Mica, 15 pF, 350V	C-6652
C2	Capacitor, Silver Mica, 33 pF, 350V	C-6659
C3	Capacitor, Silver Mica, 33 pF, 350V	C-6659
C4	Capacitor, Silver Mica, 15 pF, 350V	C-6652
L1	Inductor, Coil, Fixed	6611-0805
L2	Inductor, Coil, Fixed	6611-0806
L3	Inductor, Coil, Fixed	6611-0805
	Cover Plate	10029-2009
	Coaxial Assembly, Input (Includes A11P1)	10029-0012
	Coaxial Assembly, Output (Includes J1)	10029-2012

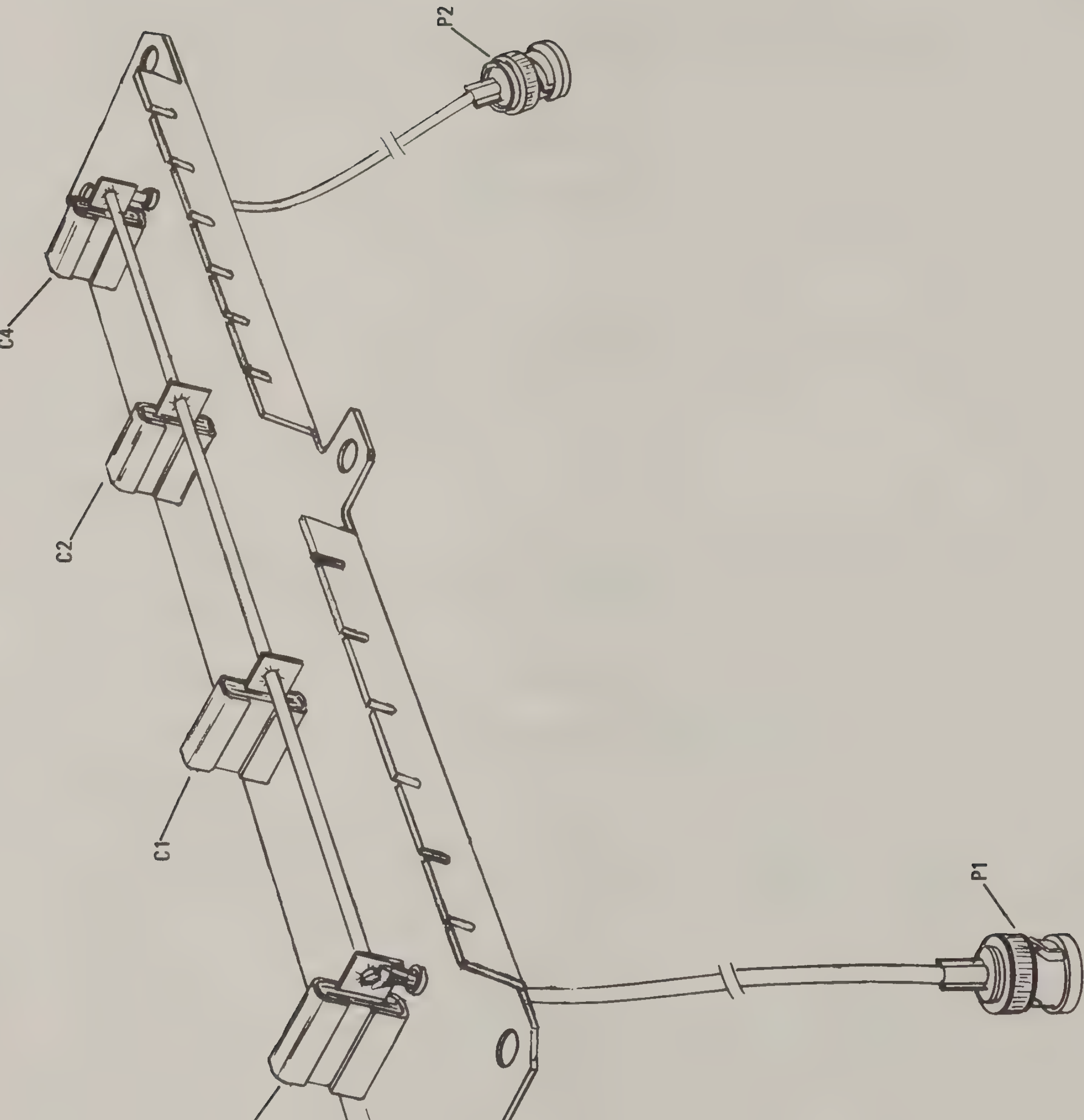

Figure 4. UHF Low-Pass Filter Module, Component Location Diagram

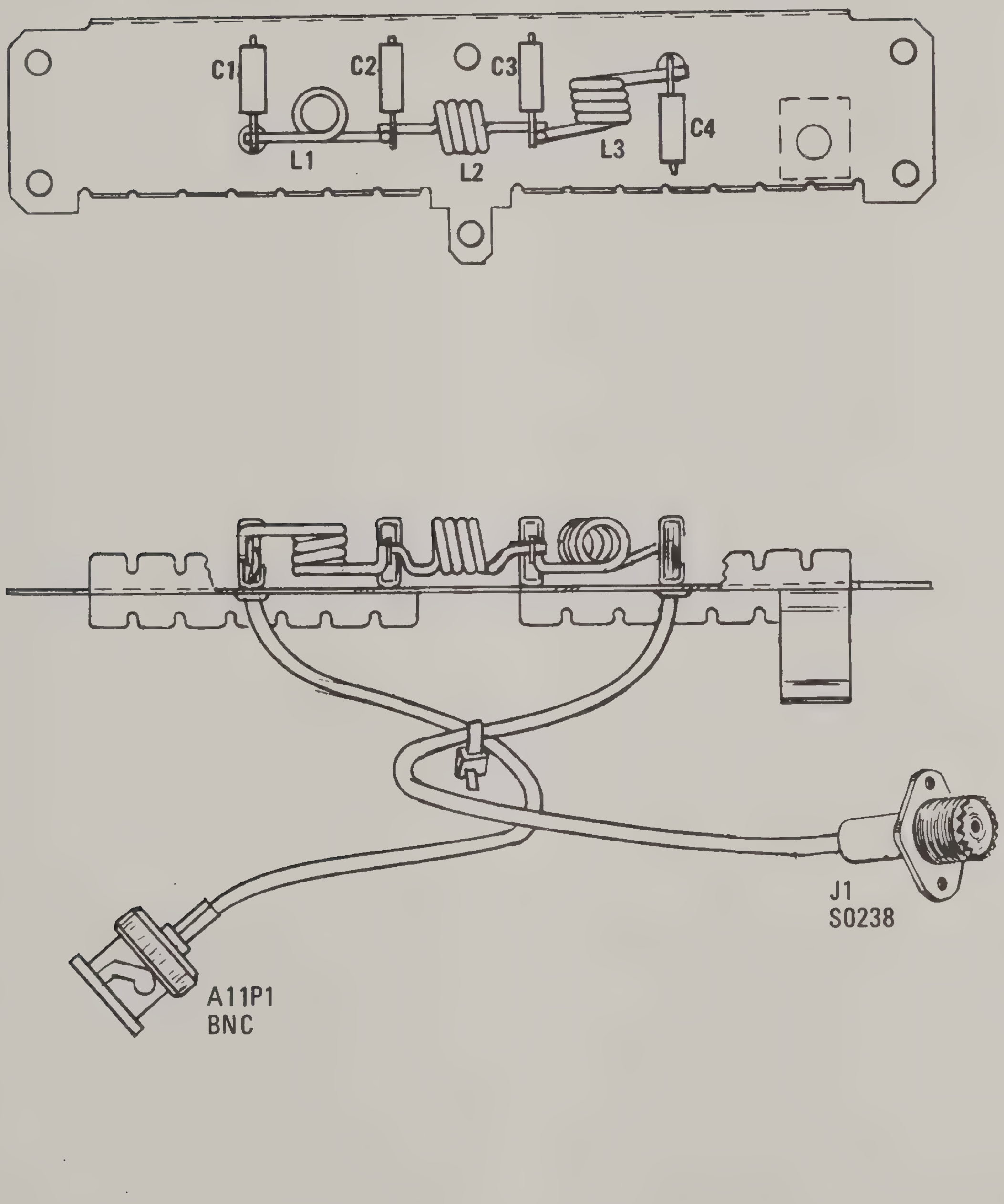

Figure 5. VHF Low-Pass Filter Module, Component Location Diagram

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INSTRUCTION MANUAL

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